US009194574B2

(12) United States Patent
Watanabe et al.

(10) **Patent No.: US 9,194,574 B2**

(45) **Date of Patent: Nov. 24, 2015**

(54) **ILLUMINATION LIGHT SOURCE**

(71) Applicant: **PANASONIC CORPORATION**, Osaka (JP)

(72) Inventors: **Kenta Watanabe**, Osaka (JP); **Atsushi Motoya**, Shiga (JP)

(73) Assignee: **PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LTD.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1 day.

(21) Appl. No.: **14/444,302**

(22) Filed: **Jul. 28, 2014**

(65) **Prior Publication Data**

US 2015/0036361 A1 Feb. 5, 2015

(30) **Foreign Application Priority Data**

Jul. 30, 2013 (JP) 2013-157479

(51) **Int. Cl.**

F21V 29/00	(2015.01)
F21V 29/507	(2015.01)
F21K 99/00	(2010.01)
F21V 29/76	(2015.01)

(52) **U.S. Cl.**

CPC ***F21V 29/507*** (2015.01); ***F21K 9/137*** (2013.01); ***F21V 29/763*** (2015.01)

(58) **Field of Classification Search**

CPC F21V 29/10; F21V 29/20; F21V 29/50; F21V 29/763; F21V 29/767; F21V 29/77; F21V 29/78

USPC 362/373, 294, 249.02

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,534,875 B1 * 9/2013 Zhang F21V 9/00 313/46
8,628,218 B2 * 1/2014 Yu F21S 8/04 362/294
8,816,575 B2 * 8/2014 Kimiya F21V 29/004 313/11
8,894,254 B2 * 11/2014 Matsuda F21S 8/026 362/249.03
2013/0016511 A1 * 1/2013 Mansfield F21K 9/00 362/244
2014/0204594 A1 7/2014 Kanazawa et al.

FOREIGN PATENT DOCUMENTS

JP 2011-258372 12/2011

* cited by examiner

Primary Examiner — Ali Alavi

(74) *Attorney, Agent, or Firm* — Greenblum & Bernstein P.L.C.

(57) **ABSTRACT**

An illumination light source includes a light emitting module having a light emitting part, a circuit unit, a base, a tube-like first housing member to accommodate the circuit unit, and a second housing member having a plurality of radiation fins. The light emitting module is disposed on one opening-side of the first housing member, while the base is disposed on the other opening-side. The second housing member includes a rotary ring body with a rotation axis agreeing with the center axis of the first housing member, and the plurality of the plate-lake radiation fins. The plurality of the radiation fins is parallel to one virtual plane containing the rotation axis, and disposed at intervals between each other in the direction orthogonal to the virtual plane. The inner wall of the rotary ring body surrounds the outer walls of the first and second housing members to combine the members.

12 Claims, 23 Drawing Sheets

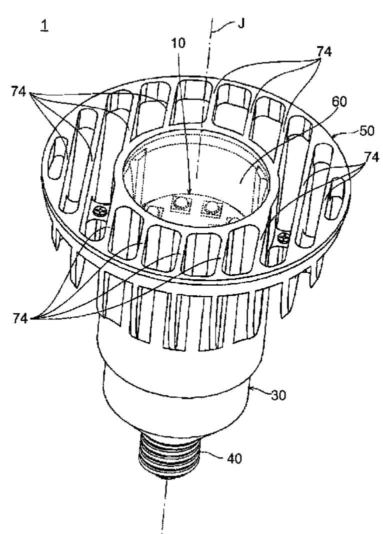


FIG. 1

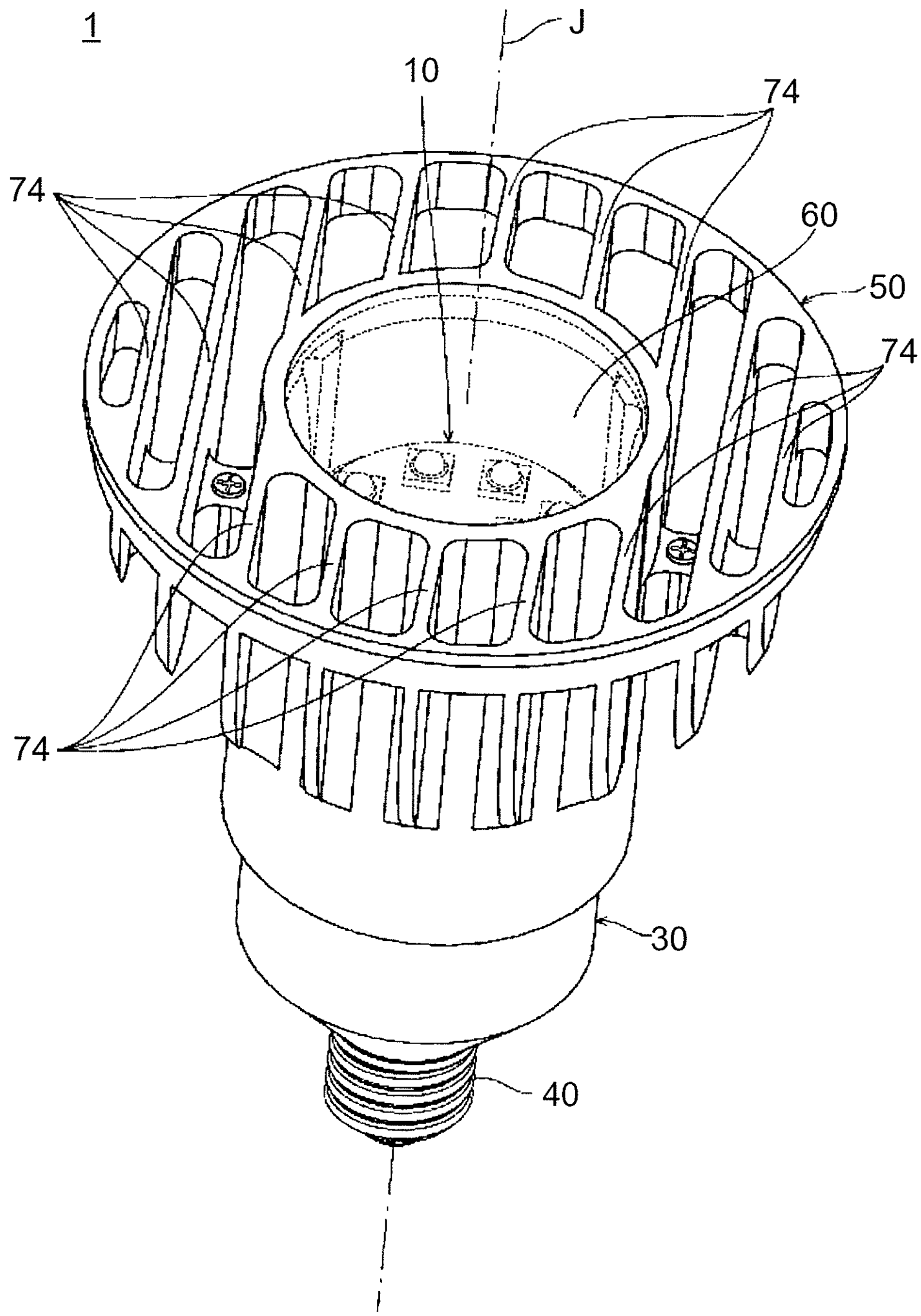


FIG. 2

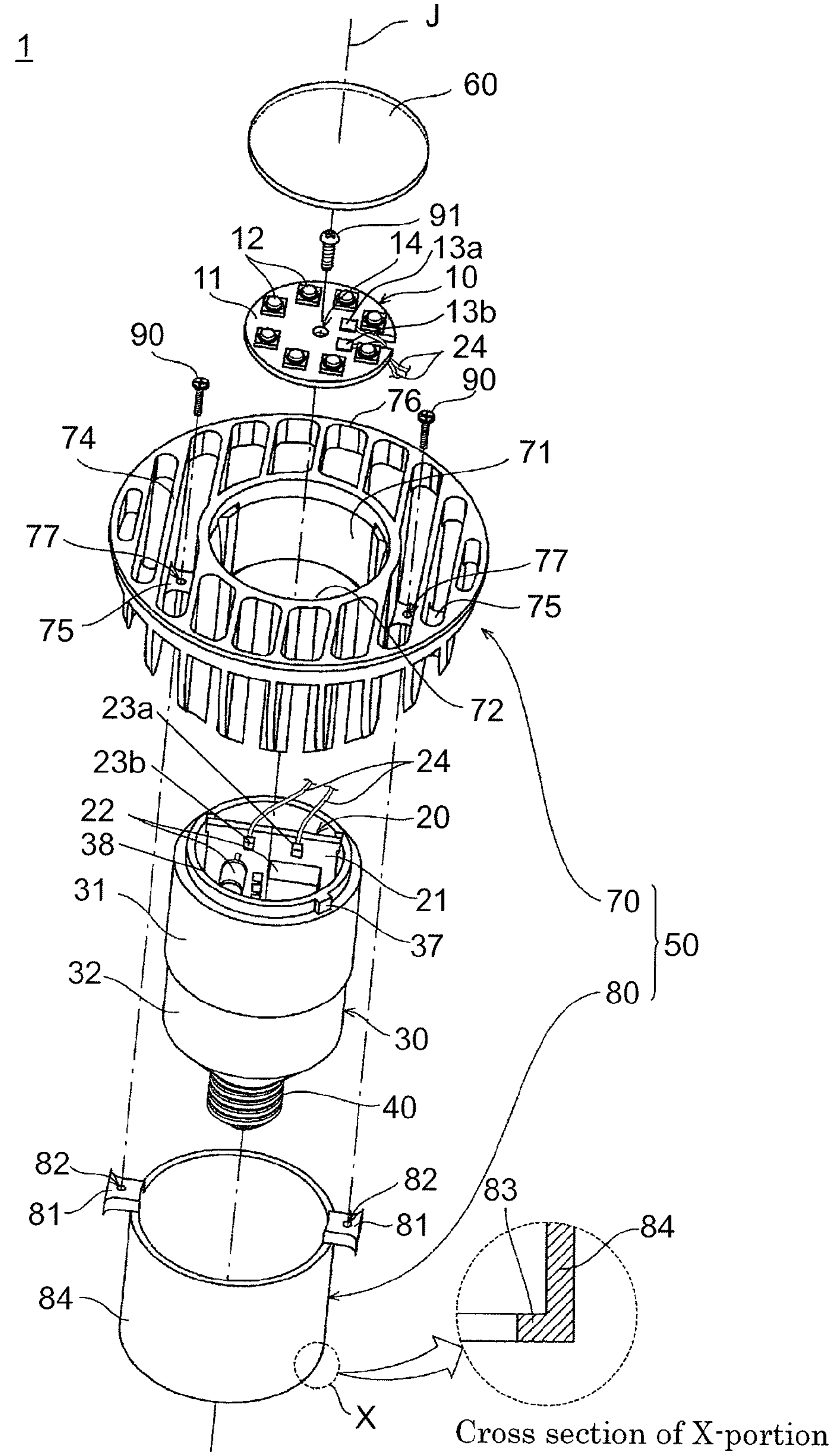
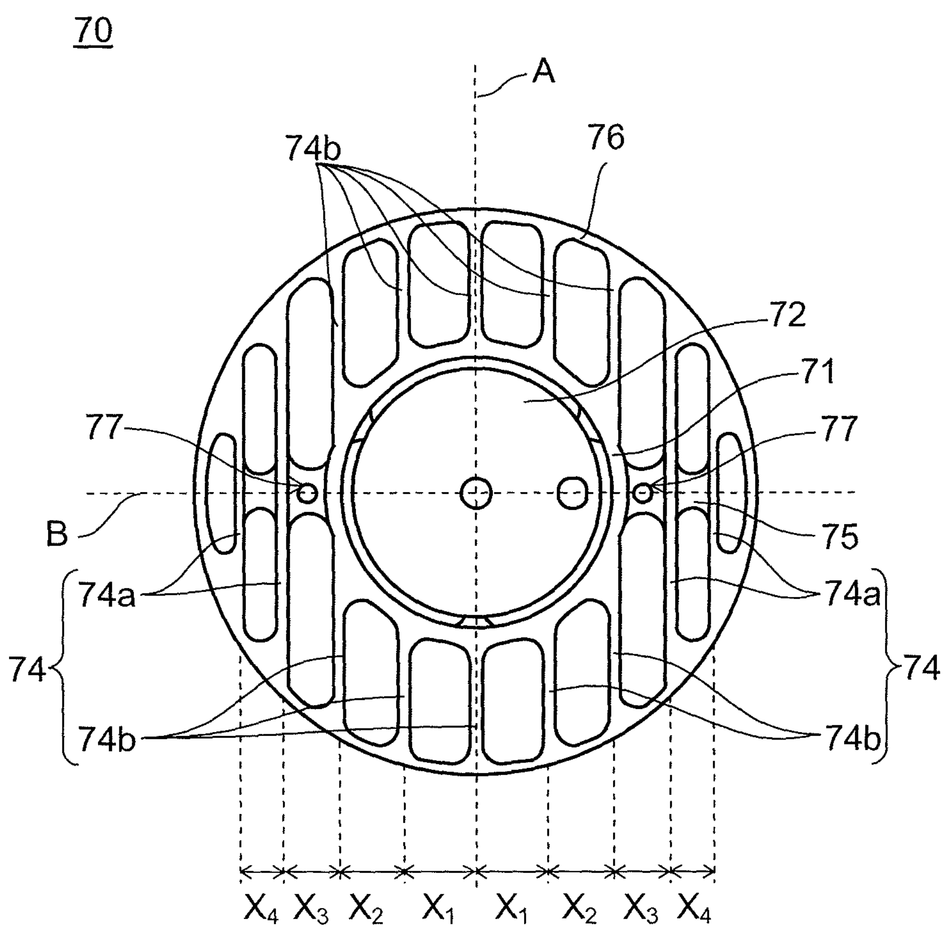

1
J
60
91
12
14
13a
10
11
13b
90
24
90
76
74
71
77
77
75
75
72
23a
23b
24
22
20
38
21
31
70
37
50
32
80
30
40
82
82
83
81
81
84
84
X
Cross section of X-portion

FIG. 3



70
A
74b
76
72
71
77
77
B
75
74a
74a
74
74
74b
74b
X_4 X_3 X_2 X_1 X_1 X_2 X_3 X_4

FIG. 4

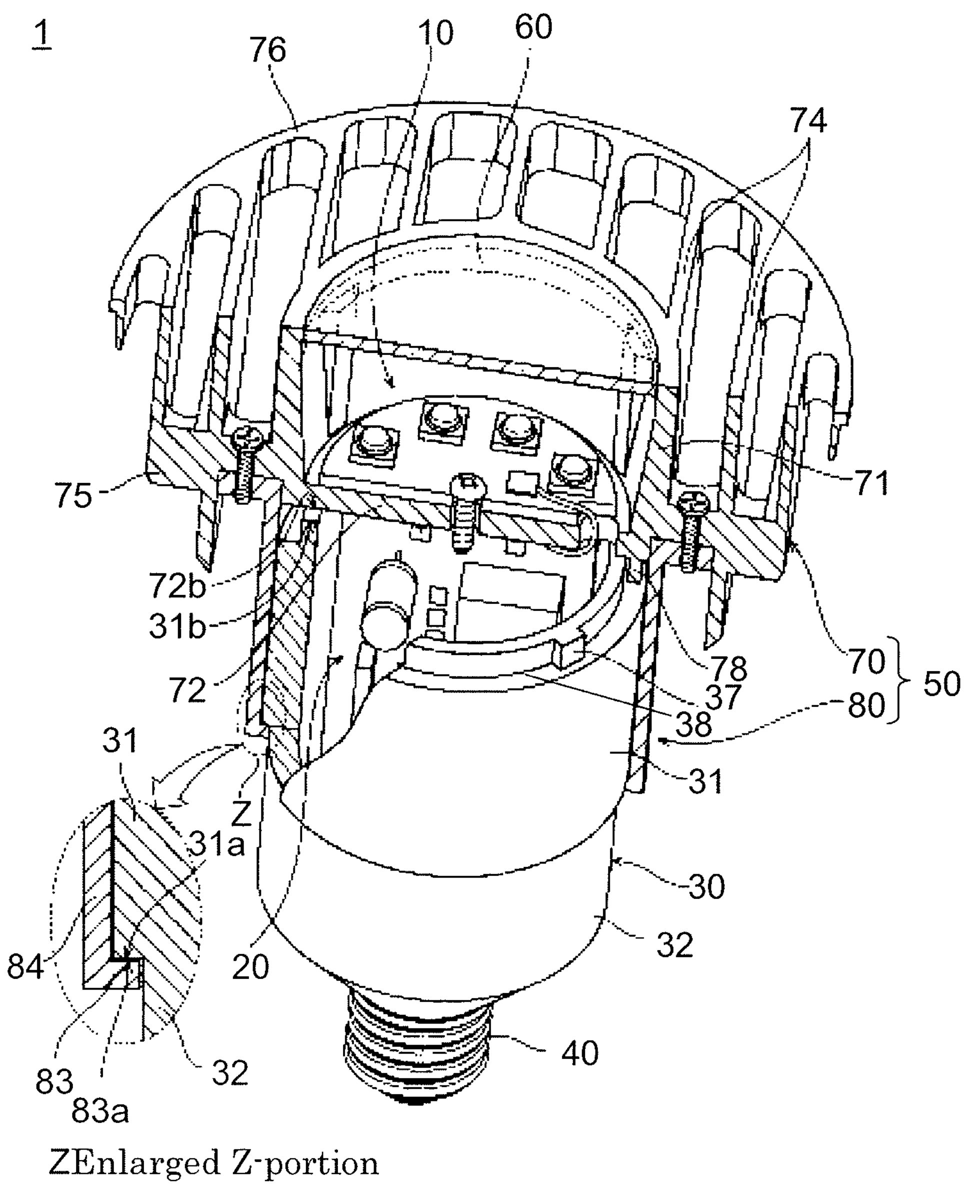

1
76
10
60
74
75
71
72b
31b
72
70
50
78
37
80
38
31
31
Z
31a
30
84
20
32
40
83
83a
32
ZEnlarged Z-portion

FIG. 5A

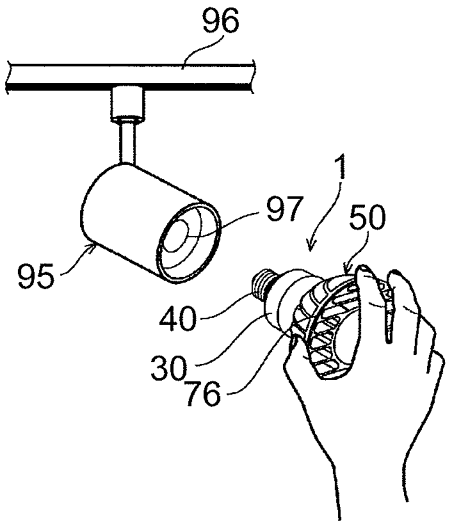


FIG. 5B

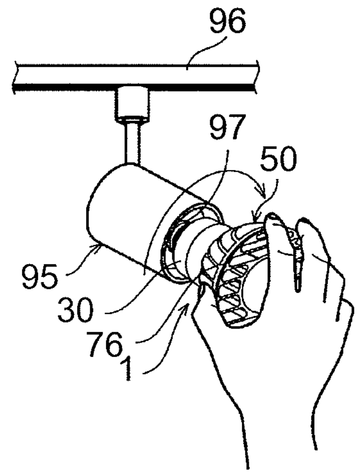


FIG. 5C

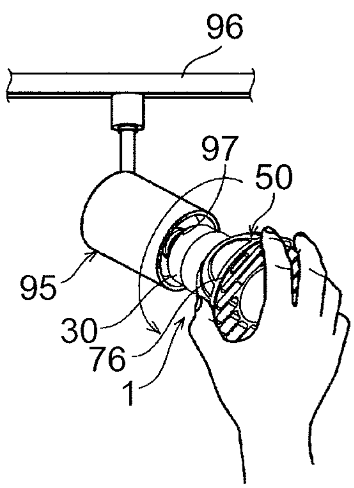


FIG. 5D

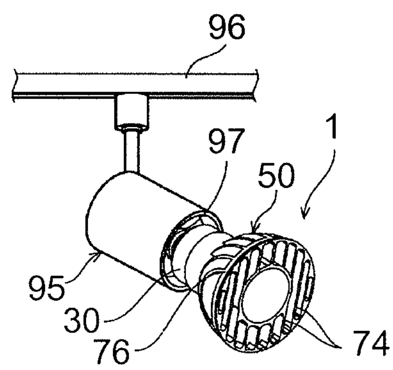


FIG. 6A

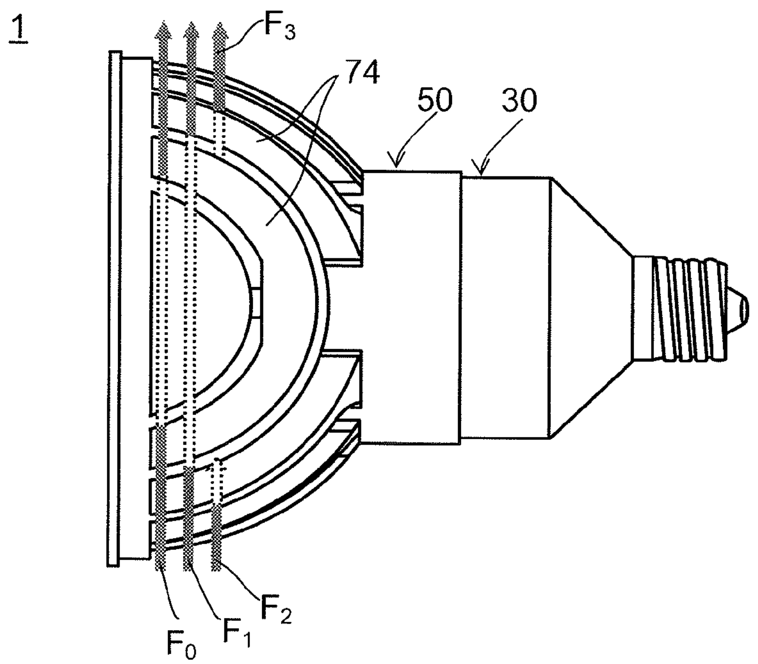


FIG. 6B

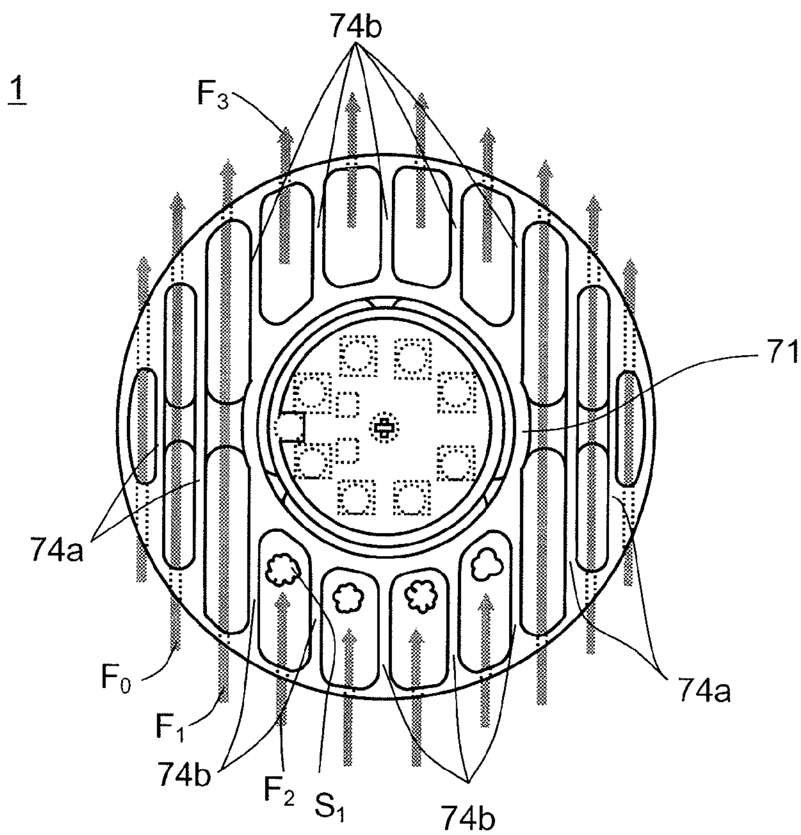


FIG. 7

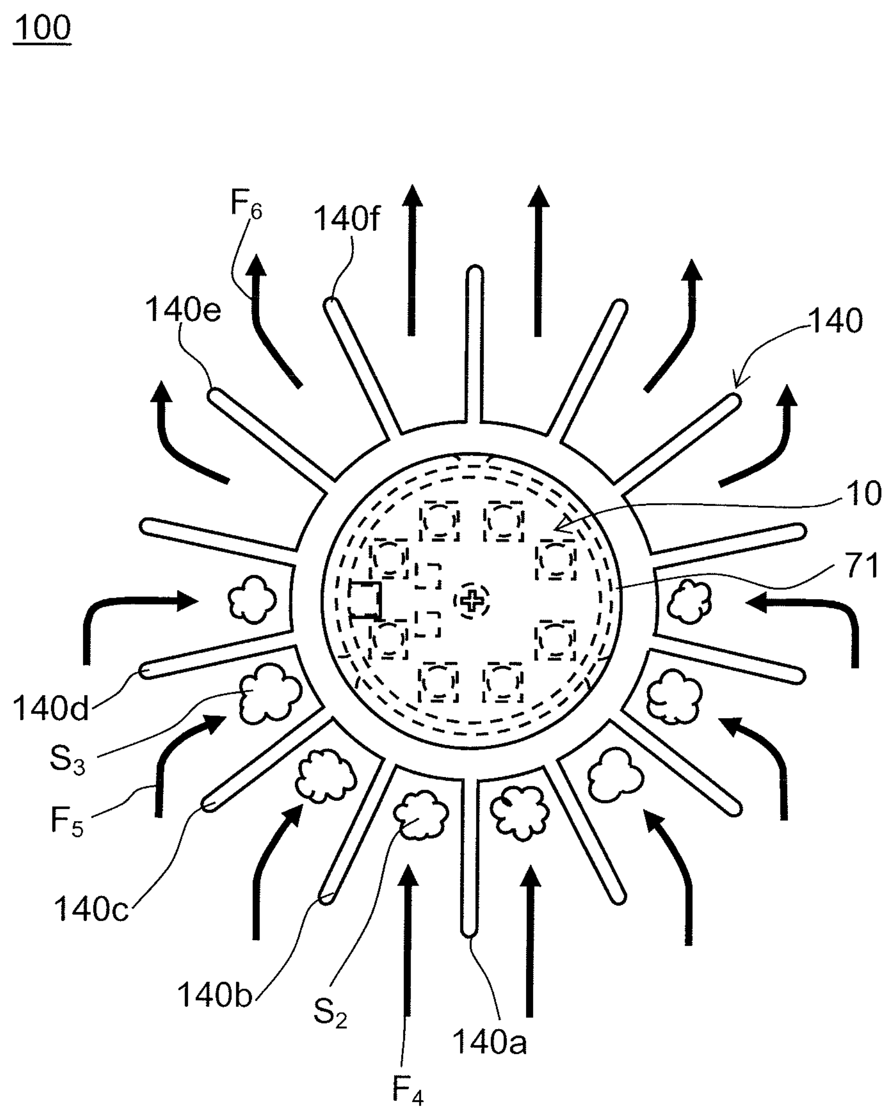
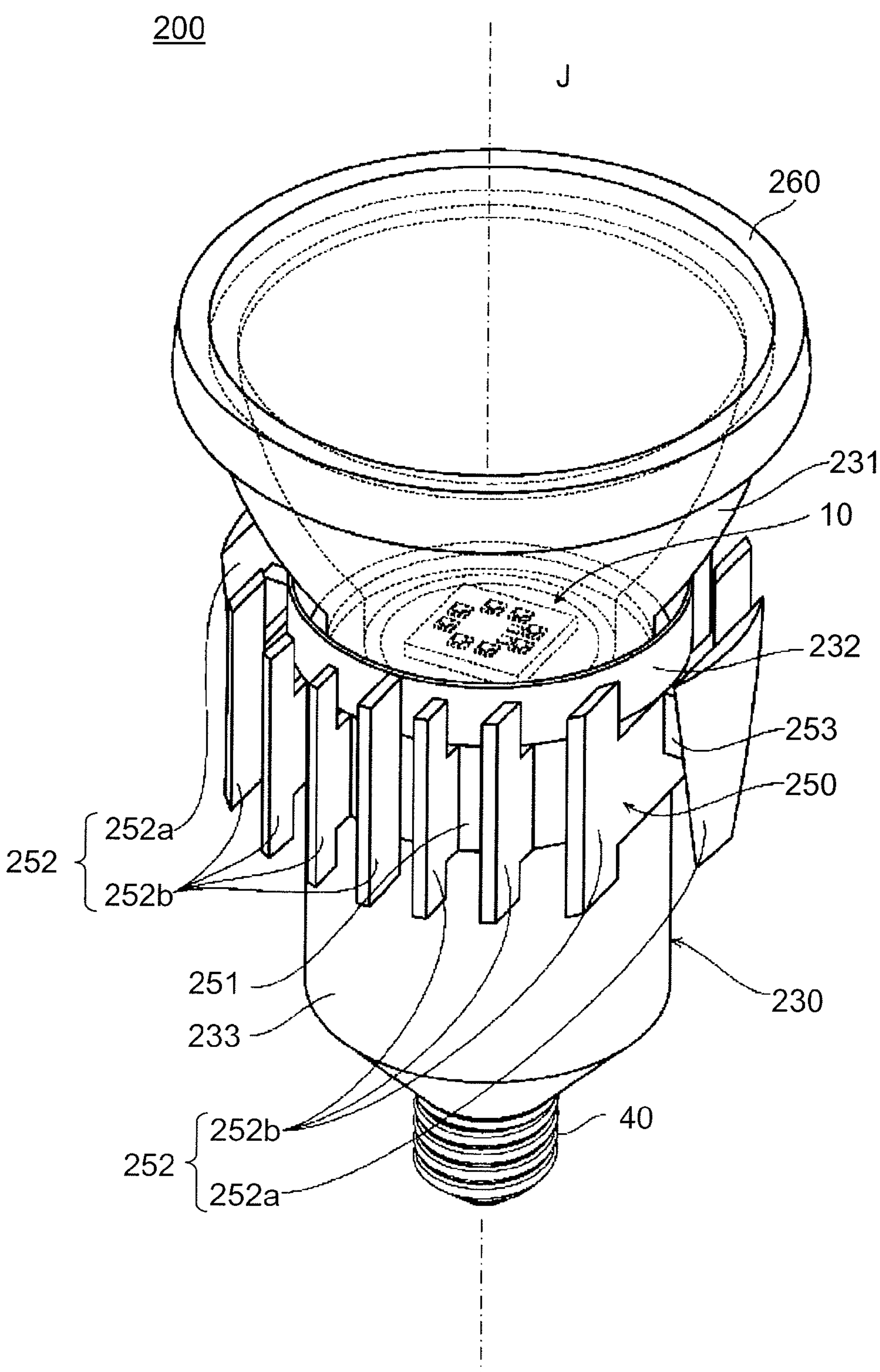


FIG. 8



200
J
260
231
10
232
253
250
252
252a
252b
251
233
230
252
252b
252a
40

FIG. 9

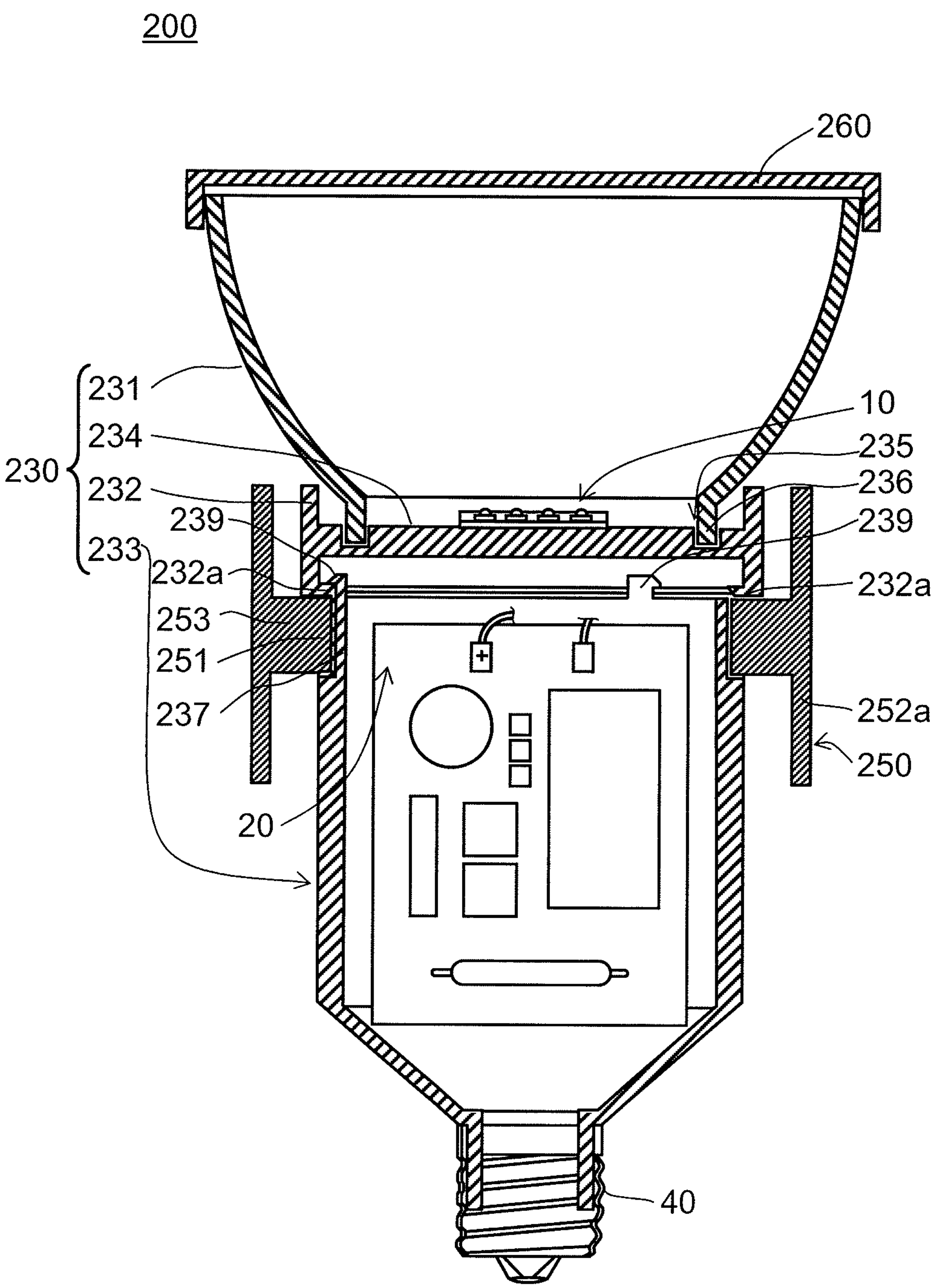

200
260
231
234
230
232
239
233
232a
253
251
237
10
235
236
239
232a
252a
250
20
40

FIG. 10

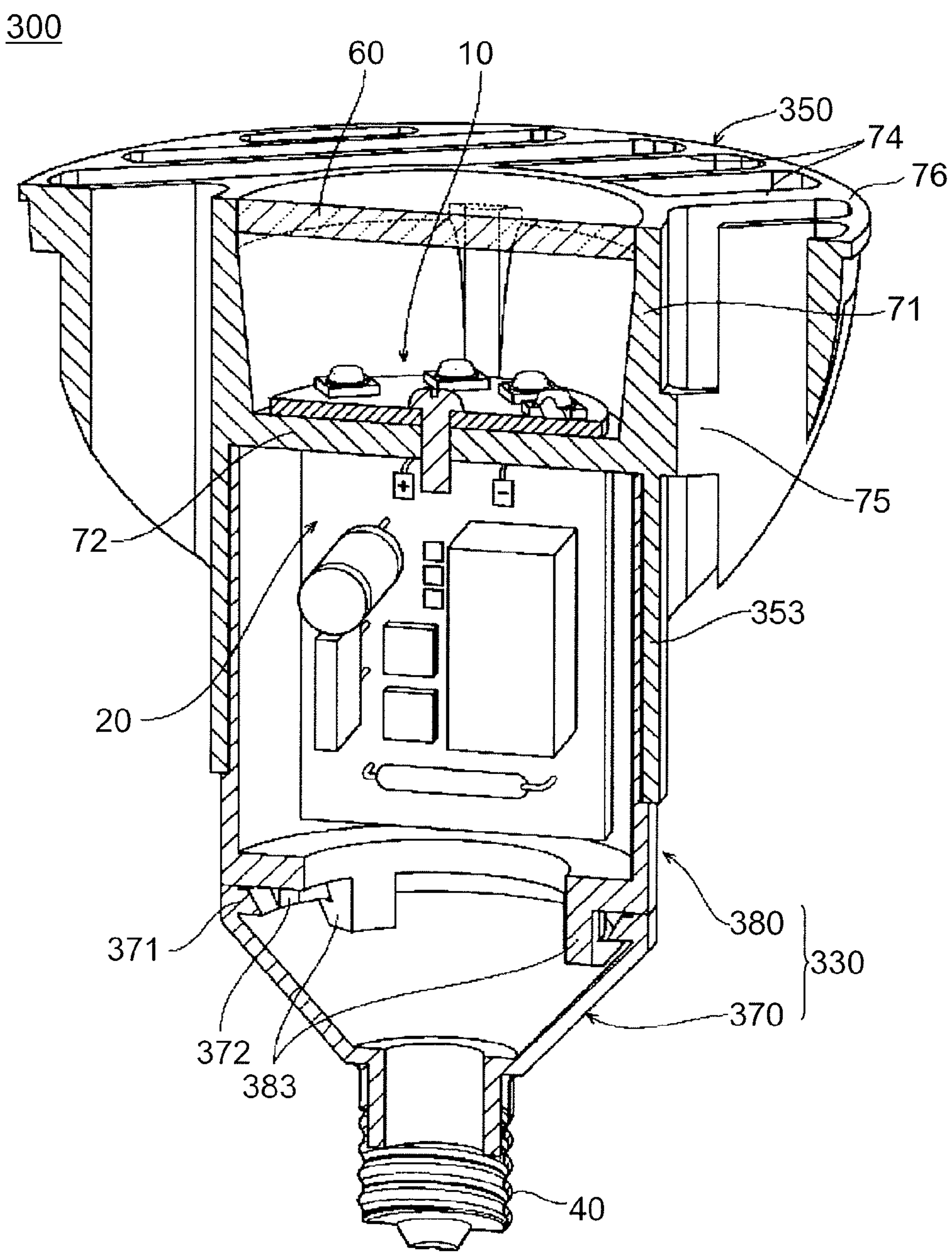


FIG. 11

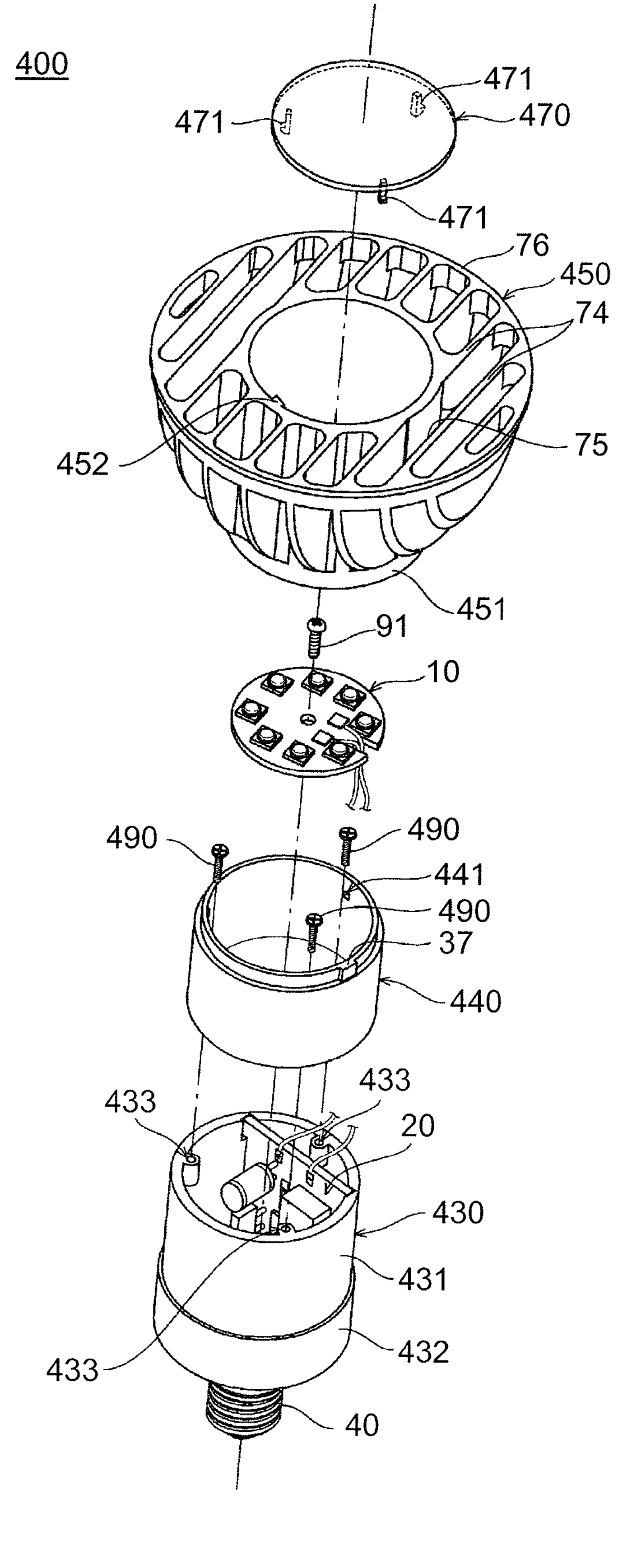

400
471
470
471
471
76
450
74
452
75
451
91
10
490
490
441
490
37
440
433
433
20
430
431
432
433
40

FIG. 12

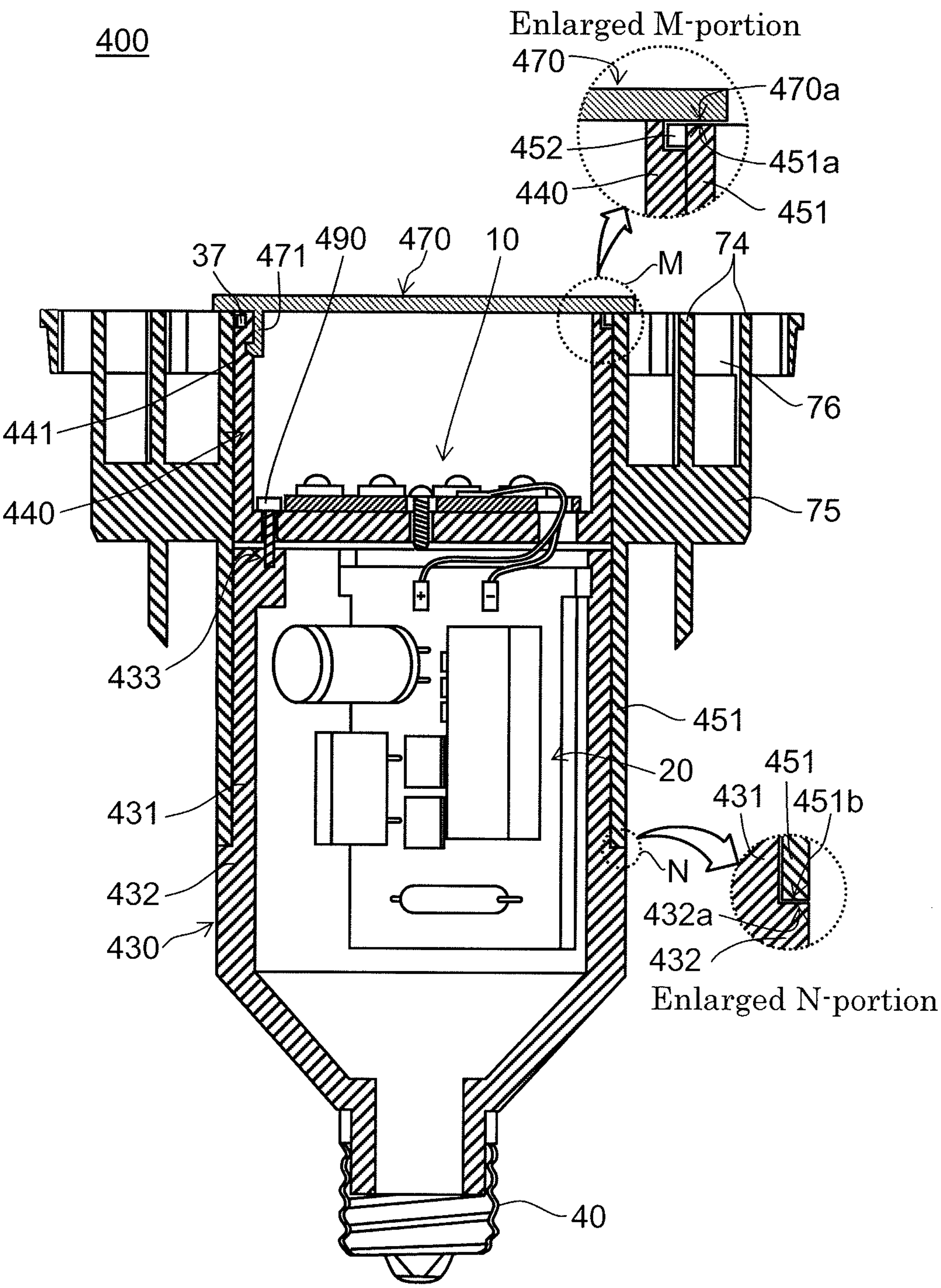

400
Enlarged M-portion
470
470a
452
451a
440
451
37
471
490
470
10
M
74
441
76
440
75
433
451
20
451
431
451b
431
N
432
432a
430
432
Enlarged N-portion
40

FIG. 13

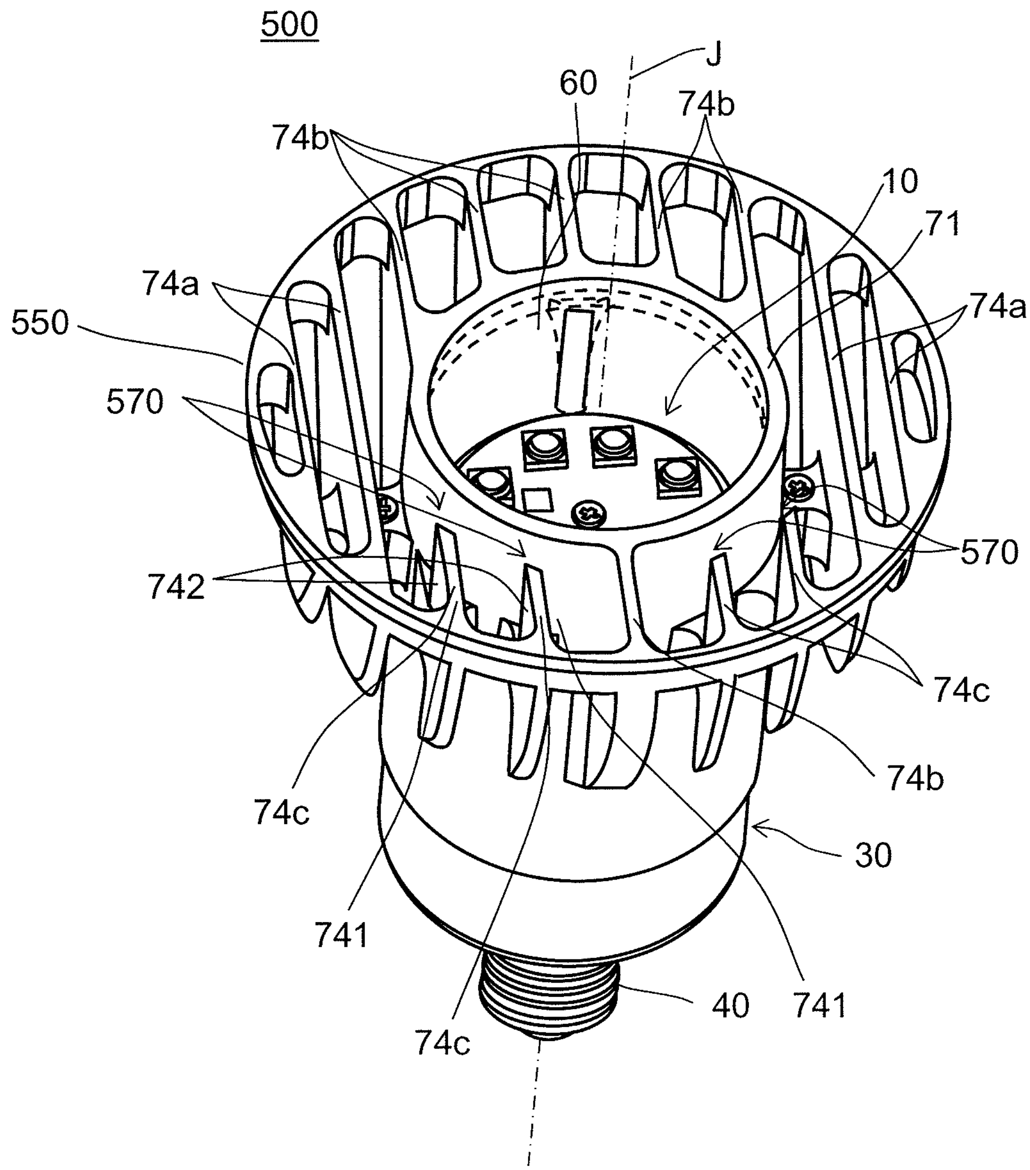

500
J
60
74b
74b
10
71
74a
74a
550
570
570
742
74c
74c
74b
30
741
741
40
74c

FIG. 14

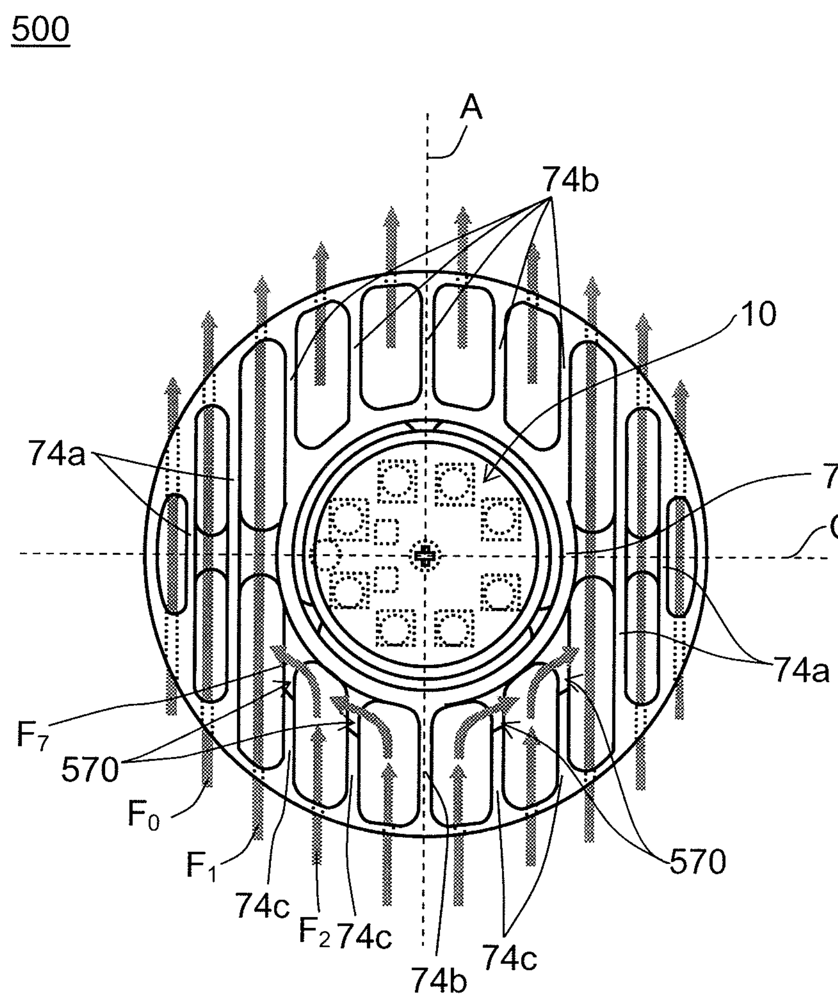


FIG. 15

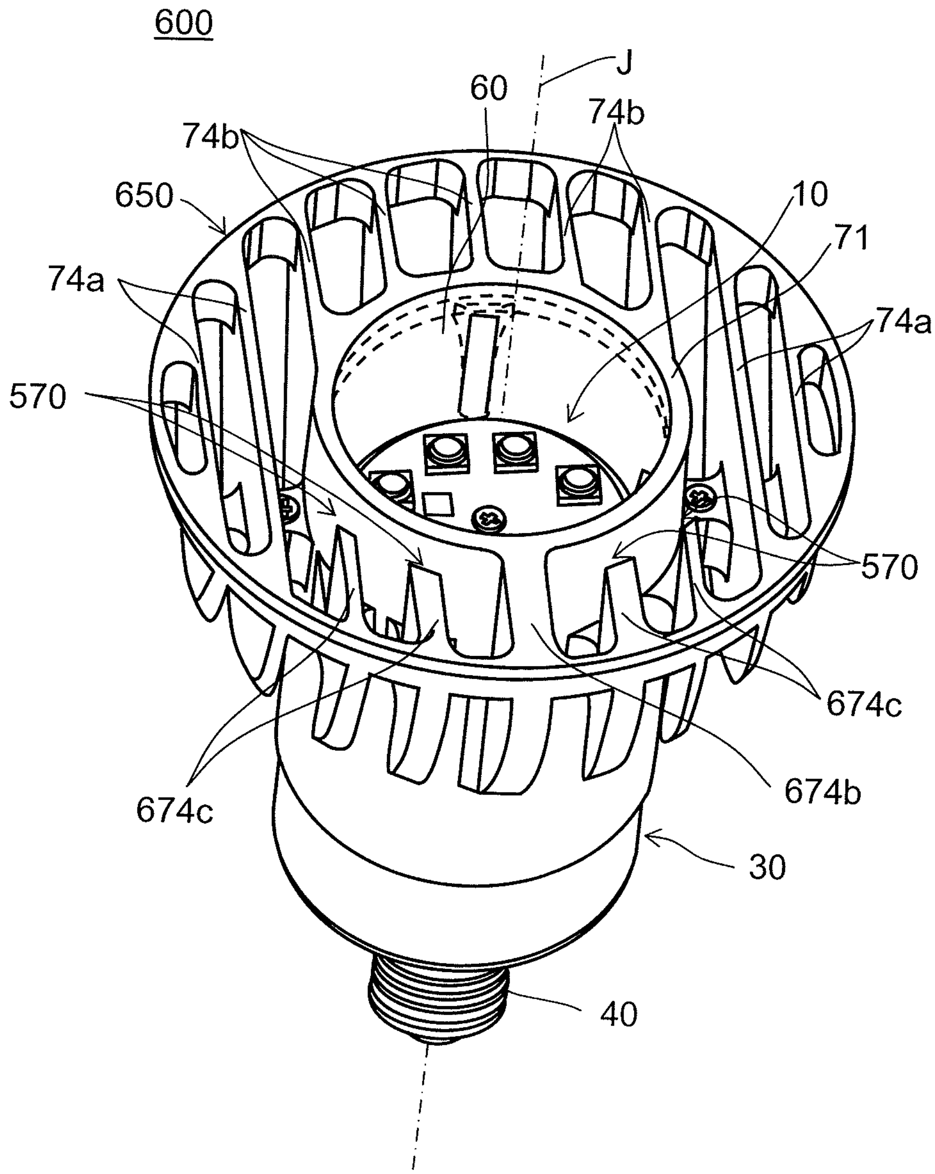


FIG. 16

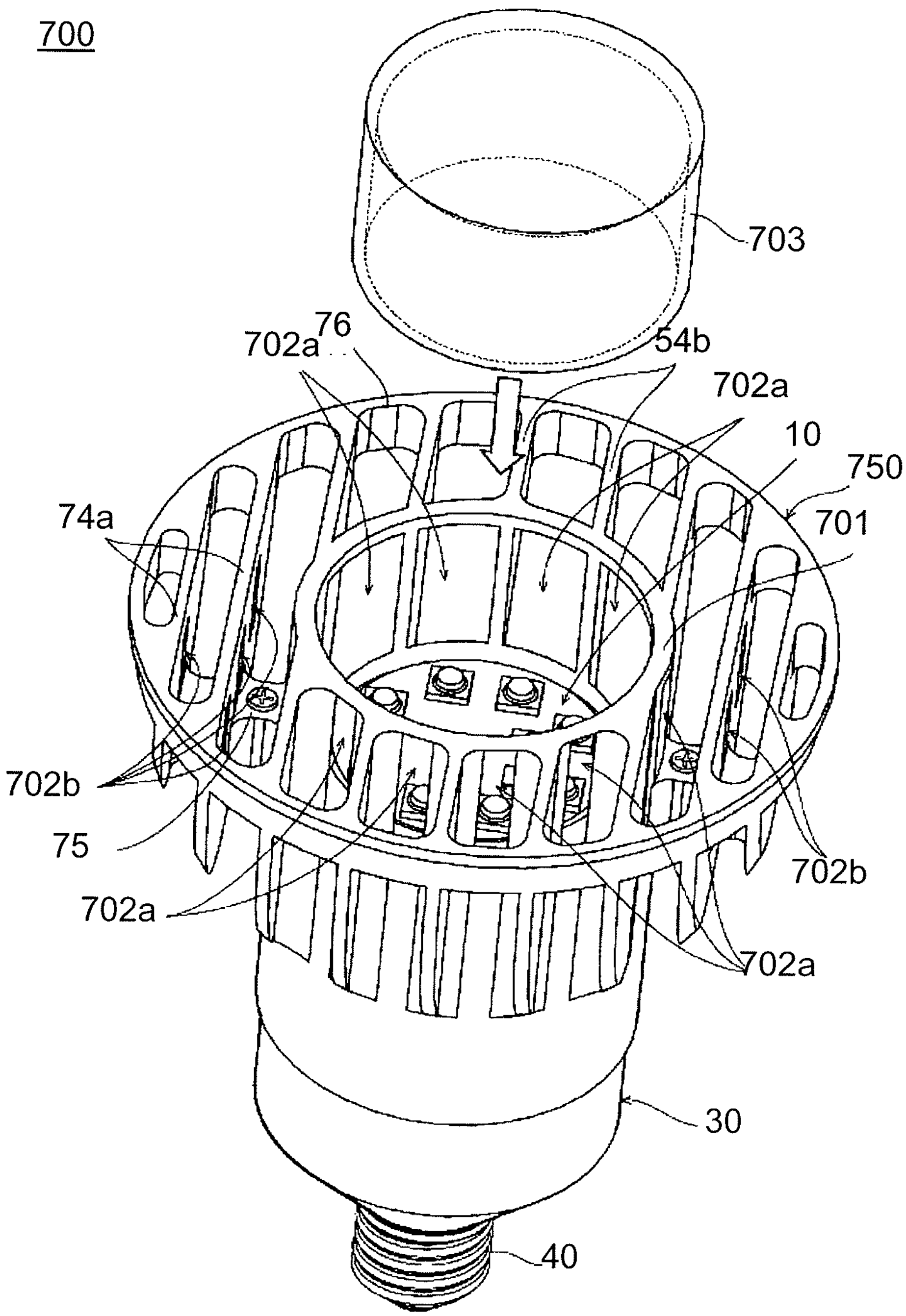

700
703
702a
76
54b
702a
10
750
701
74a
702b
75
702a
702b
702a
30
40

FIG. 17A

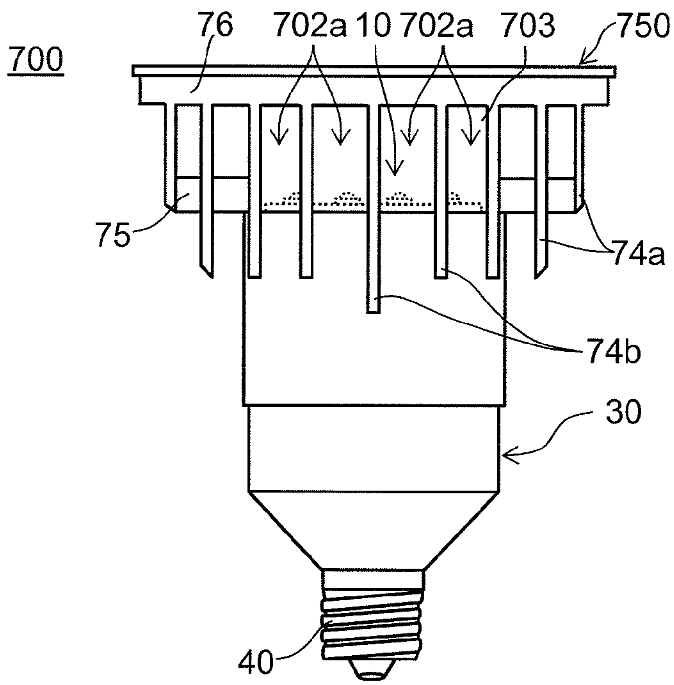


FIG. 17B

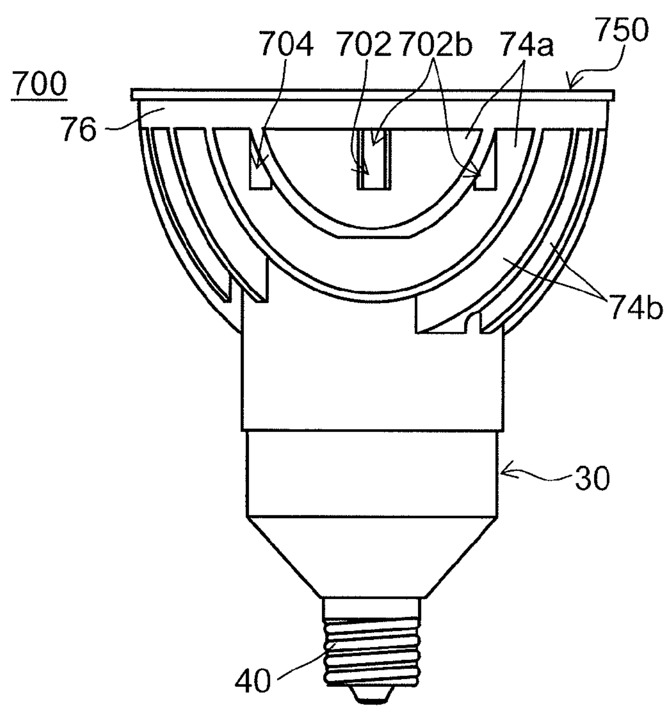


FIG. 18

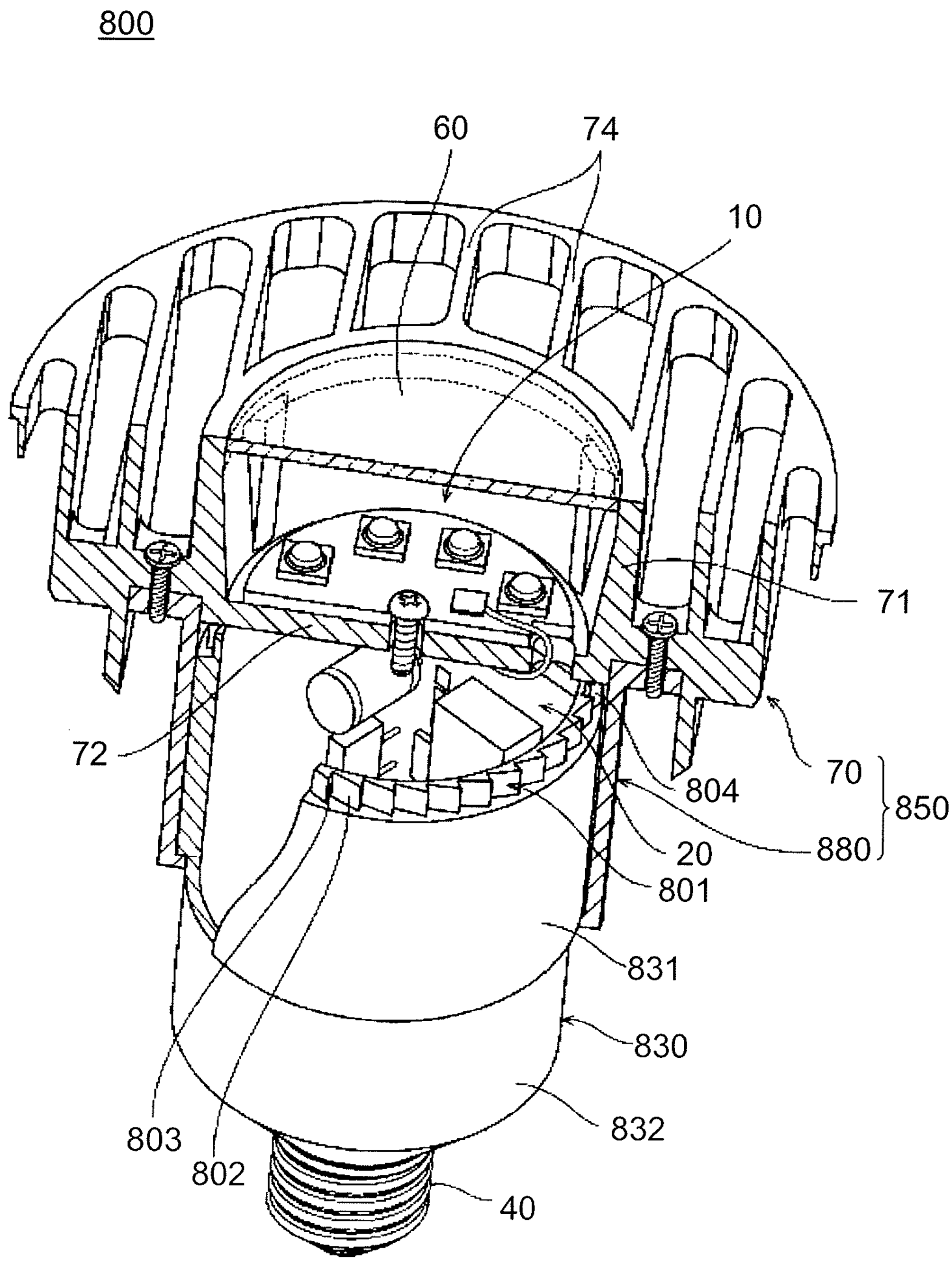
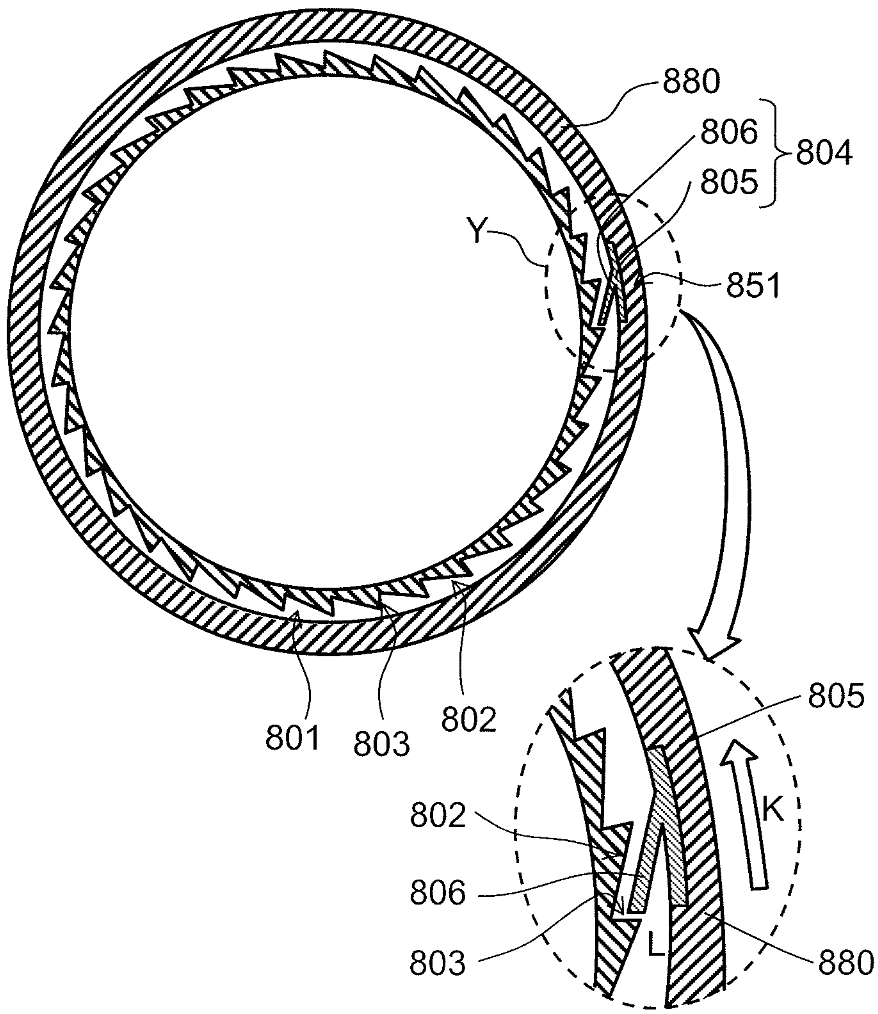


FIG. 19



Enlarged Y-portion

FIG. 20

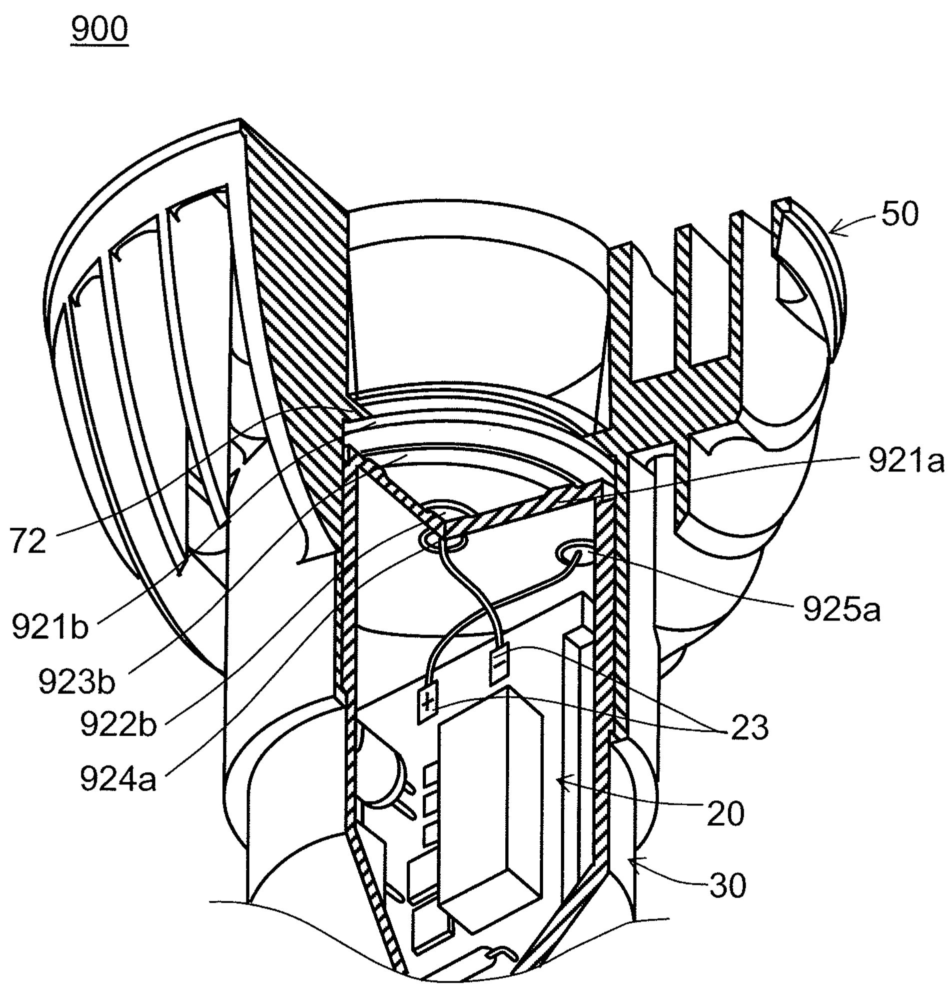
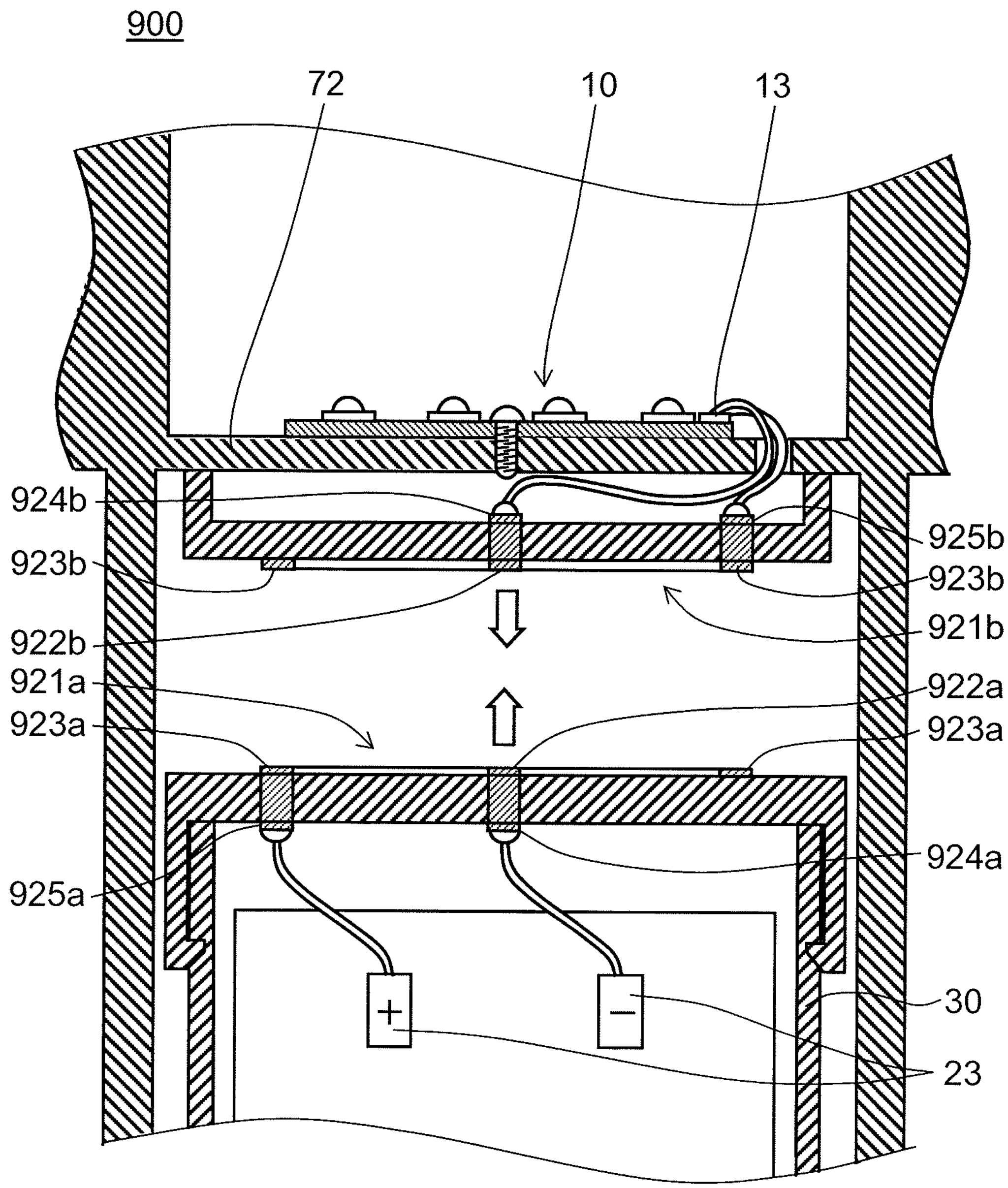


FIG. 21



900
72
10
13
924b
925b
923b
923b
922b
921b
921a
922a
923a
923a
924a
925a
+
−
30
23

FIG. 22

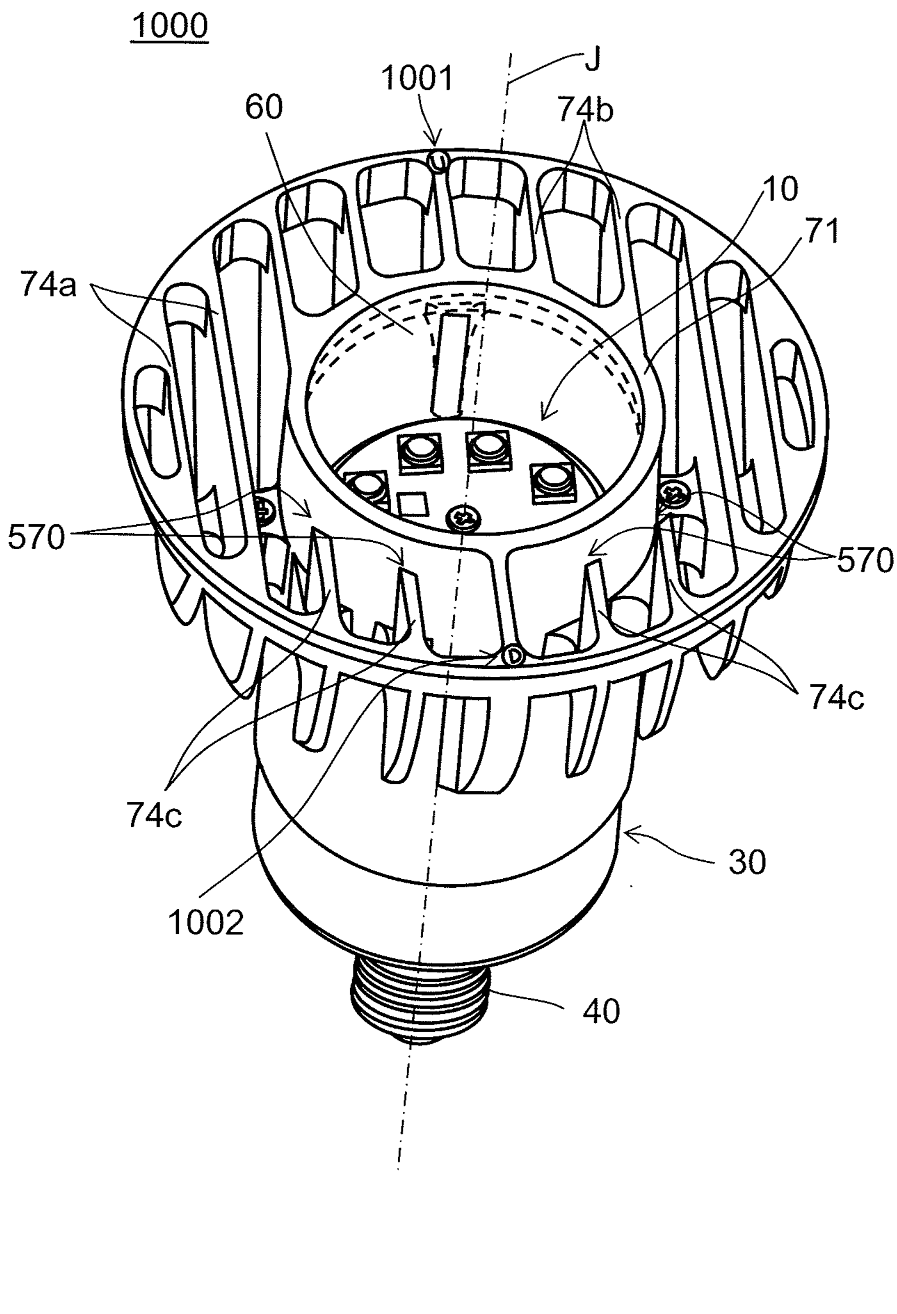
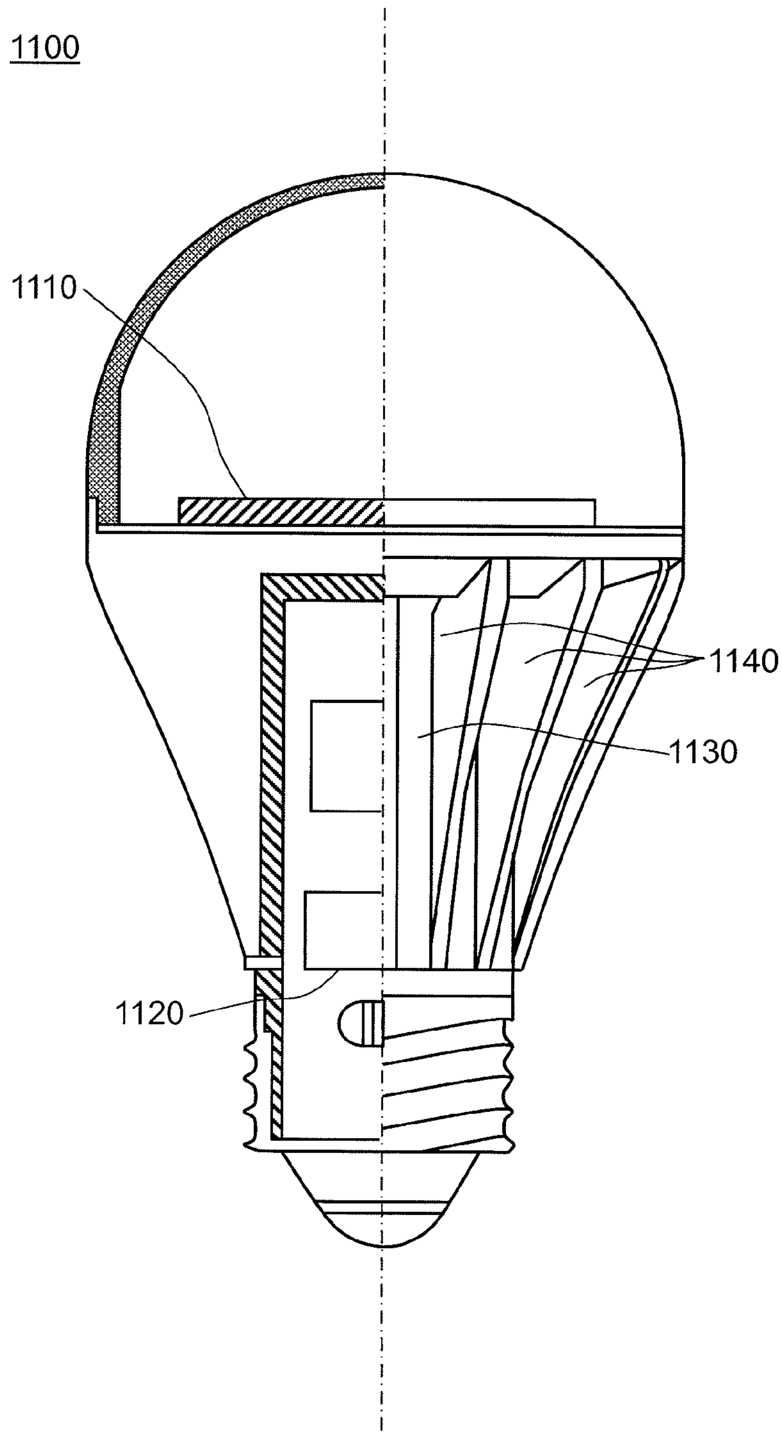


FIG. 23



ILLUMINATION LIGHT SOURCE

FIELD OF THE INVENTION

The present disclosure relates to illumination light sources which employ LEDs (Light Emitting Diodes) and the like as their light sources.

BACKGROUND OF THE INVENTION

In recent years, there have been introduced illumination light sources which use LEDs as light sources, in view of energy saving.

FIG. **23** is a partial cross-sectional view of an illumination light source according to a related art. Illumination light source **1100** includes light emitting module **1110** having LEDs, circuit unit **1120** to make light emitting module **1110** light up, and case **1130** with a substantially-cylindrical shape to accommodate circuit unit **1120**. On the outer wall of case **1130**, a plurality of radiation fins **1140** with a flat-plate shape is radially disposed.

Generally, illumination light source **1100** is mounted on a ceiling and the like, in the vertically downward direction. In this mode of usage, when illumination light source **1100** lights up, heat is generated by such as light emitting module **1110** and circuit unit **1120** to warm surrounding air of illumination light source **1100**. This generates air streams around illumination light source **1100**, which flow in the vertically upward direction. The air streams flowing vertically upward can smoothly pass through gaps between radiation fins **1140**, which allows every radiation fin **1140** to perform heat exchange with outside air.

SUMMARY OF THE INVENTION

An illumination light source according to various embodiments includes a light emitting module having light emitting parts, a circuit unit, a base, a first housing member with a tube-like shape to accommodate the circuit unit, and a second housing member having a plurality of radiation fins.

The light emitting module is electrically coupled with the circuit unit. The circuit unit is electrically coupled with the base. The light emitting module is disposed on one opening side of the tube-like first housing member, while the base is disposed on the other opening side.

The second housing member includes a plurality of plate-like radiation fins, and a rotary ring body having a rotation axis agreeing with the center axis of the first housing member. The plurality of the radiation fins are in parallel with a virtual plane containing the rotation axis, and is disposed at intervals between each other in the direction orthogonal to the virtual plane. The inner wall of the rotary ring body surrounds the outer wall of the tube-like shape, so that the first housing member is combined with the second housing member. The second housing member is rotatably attached to the first housing member, about the center axis.

With the configuration described above, even when the illumination light source is mounted at an inclination relative to the vertical direction, it is possible to efficiently radiate the heat generated from the light emitting module and the like.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of an appearance configuration of an illumination light source according to the embodiment.

FIG. **2** is an exploded perspective view of the illumination light source shown in FIG. **1**.

FIG. **3** is an elevational view of a radiation member shown in FIG. **1**.

FIG. **4** is a partial cross-sectional view of the illumination light source shown in FIG. **1**.

FIG. **5**A is a view of an exemplified mode of use of the illumination light source shown in FIG. **1**, which illustrates the state before the illumination light source is attached to a lighting fixture.

FIG. **5**B is a view of the exemplified mode of use of the illumination light source shown in FIG. **1**, which illustrates the state where a base of the illumination light source is being screwed into a socket.

FIG. **5**C is a view of the exemplified mode of use of the illumination light source shown in FIG. **1**, which illustrates the state where the orientation of a plurality of radiation fins is being adjusted.

FIG. **5**D is a view of the exemplified mode of use of the illumination light source shown in FIG. **1**, which illustrates the state after the orientation of the plurality of the radiation fins has been adjusted.

FIG. **6**A is a side-elevational view of the illumination light source shown in FIG. **1**, which illustrates air streams during lighting-up of the light source.

FIG. **6**B is an elevational view of the illumination light source shown in FIG. **1**, which illustrates the air streams during the lighting-up of the light source.

FIG. **7** is a view of an illumination light source of a Comparative Example, which illustrates air streams during lighting-up of the light source.

FIG. **8** is a perspective view of another illumination light source according to the embodiment.

FIG. **9** is a cross-sectional side-elevation view of the another illumination light source shown in FIG. **8**.

FIG. **10** is a perspective cross-sectional view of further another illumination light source according to the embodiment.

FIG. **11** is an exploded perspective view of each of members which configure yet further another illumination light source according to the embodiment.

FIG. **12** is a cross-sectional, side-elevational view of the yet further another illumination light source shown in FIG. **11**.

FIG. **13** is a perspective view of another illumination light source according to the embodiment.

FIG. **14** is an elevational view of the another illumination light source shown in FIG. **13**, which illustrates air streams during lighting-up of the light source.

FIG. **15** is a perspective view of further another illumination light source according to the embodiment.

FIG. **16** is a perspective view of yet further another illumination light source according to the embodiment.

FIG. **17**A is a side-elevational view of an appearance of the yet further another illumination light source shown in FIG. **16**.

FIG. **17**B is a side-elevational view of the appearance of the yet further another illumination light source shown in FIG. **17**A, as viewed from a 90-degree-turned position.

FIG. **18** is a partial cross-sectional view of an illumination light source of Modified Example 1 according to the embodiment.

FIG. **19** is a cross-sectional view of the illumination light source shown in FIG. **18**, taken along a plane orthogonal to the center axis of a case.

FIG. **20** is a partial cross-sectional view of an illumination light source of Modified Example 2 according to the embodiment.

FIG. **21** is a cross-sectional, side-elevational view of the illumination light source shown in FIG. **20**.

FIG. **22** is a perspective view of an illumination light source of Modified Example 3 according to the embodiment.

FIG. **23** is a partial cross-sectional view of an illumination light source according to a related art.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Prior to descriptions of embodiments, problems of illumination light sources according to a related art will be described. In illumination light source **1100** shown in FIG. **23**, heat exchange with outside air is sometimes inefficiently performed depending on the mounting posture of the light source to a lighting fixture and the like. Specifically, when illumination light source **1100** is mounted in a direction either slanting relative to or orthogonal to the vertical direction, air streams flowing vertically upward are less prone to flow due to blockage by plate surfaces of each of radiation fins **1140**. For this reason, the warmed air tends to stagnate inside gaps between radiation fins **1140**, resulting in a reduced efficiency of the heat radiation of each of radiation fins **1140**.

Illumination light sources according to the embodiments of the present disclosure will be described, with reference to the accompanying drawings. It is noted, however, that all of the embodiments to be described hereinafter are intended only to illustrate preferred specific examples. Consequently, values, shapes, materials, elements, arrangements and locations of the elements, coupling modes of the elements, and the like to be described hereinafter are nothing more than specific examples, and are in no way intended to limit the present disclosure.

In addition, each of the accompanying figures is schematic, and is not necessarily an accurate illustration. Throughout the figures, substantially identical structures are designated by the same reference numerals and symbols, and duplicate explanations thereof will be omitted or simplified.

[Appearance Configuration]

FIG. **1** is a perspective view of an appearance configuration of illumination light source **1** according to the embodiment. The exterior of illumination light source **1** is configured with case **30**, base **40**, radiation member **50**, and cover **60**. Case **30** serves as a first housing member. Radiation member **50** serves as a second housing member. Case **30** has a substantially-cylindrical shape, and its center axis J is agreeing with the rotation axis of illumination light source **1**. Radiation member **50** includes a plurality of flat-plate radiation fins **74**. In a hollow part which is disposed in the center portion of radiation member **50**, light emitting module **10** is accommodated which includes light emitting parts **12**. Cover **60** is a disk-like member which covers an opening disposed in the center portion of radiation member **50**.

[Basic Configuration of Each Member]

FIG. **2** is an exploded perspective view of each of members which configure illumination light source **1**.

(Light Emitting Module)

Light emitting module **10** includes mounting substrate **11**, a plurality of light emitting parts **12** disposed on mounting substrate **11**, and first connection terminal **13***a* and second connection terminal **13***b* (hereinafter, referred to as "connection terminals **13***a* and **13***b*"). Mounting substrate **11** is a metal-base substrate which is configured with a resin plate and a metal plate, for example. On the upper surface of the substrate, a wiring pattern (not shown) is disposed. Each of light emitting parts **12** is configured with a semiconductor light-emitting element such as an LED. Connection terminals **13***a* and **13***b* are electrically coupled with each of light emitting parts **12** via the wiring pattern.

(Circuit Unit)

Circuit unit **20** includes circuit board **21** and various kinds of electronic components **22** mounted on circuit unit **20**. On circuit board **21**, there are disposed first connection terminal **23***a* and second connection terminal **23***b* (hereinafter, referred to as "connection terminals **23***a* and **23***b*"). Connection terminals **23***a* and **23***b* are electrically coupled with connection terminals **13***a* and **13***b* of light emitting module **10**, respectively, via lead wires **24**. Moreover, circuit unit **20** is electrically coupled with base **40** via lead wires (not shown).

(Case)

Case **30** serving as the first housing member is substantially cylindrical, and includes large-diameter part **31** and small-diameter part **32**. Case **30** is rotationally symmetric about center axis J. In the inside of case **30**, circuit unit **20** is accommodated. Case **30** is formed with an electrical insulating material such as a resin or a ceramic, for example.

(Base)

Base **40** is a so-called Edison-type screw base, and is disposed at an opening end part on one end side of case **30**.

(Radiation Member)

Radiation member **50** serving as the second housing member is an integrally-molded article which is configured with a material excellent in heat conductivity, such as aluminum, copper, or iron. Radiation member **50** is operative to radiate heat to the outside, with the heat being generated from light emitting module **10** and circuit unit **20**. Radiation member **50** is configured with first radiation member **70** and second radiation member **80**, with the first and second members being combined with each other with screws **90**. Radiation member **50** has a rotation mechanism, the rotation axis of which is agreeing with center axis J of the first housing member.

First radiation member **70** includes tube-like part **71**, bottom plate **72**, a plurality of radiation fins **74**, connection parts **75**, and rim part **76**.

Tube-like part **71** is substantially cylindrical, and plays a role of a peripheral wall of the hollow part which accommodates light emitting module **10** therein.

Bottom plate **72** has a substantially disk-like shape, and plays a role of a bottom wall of the hollow part which accommodates light emitting module **10** therein. In the center portion of bottom plate **72**, a screw hole is disposed (not shown in FIG. **2**). Screw **91** is inserted into hole **14** of light emitting module **10**, and then screw **91** is screwed into the screw hole to fix light emitting module **10** to bottom plate **72**.

Radiation fins **74** each have a flat-plate shape, and are in parallel with one another. Specifically, as shown in the elevational view of FIG. **3**, each of radiation fins **74** is disposed in such a manner that: That is, the fin is in parallel with a virtual plane (hereinafter, referred to as plane A) which contains the rotation axis of tube-like part **71**, and is away from the next fin in the orthogonal direction (hereinafter, referred to as direction B) relative to plane A. In the figure, X1 to X4 represent gaps between adjacent radiation fins **74**. The gaps between adjacent radiation fins **74** are preferably set to become smaller, with increasing distance from the center to the adjacent fins in direction B (X1>X2>X3>X4).

Radiation fins **74** are preferably configured with first radiation fins **74***a* and second radiation fins **74***b*. First radiation fins **74***a* are disposed to be outward away from the outer wall of tube-like part **71**, in direction B. Second radiation fins **74***b* are disposed on the outer wall of tube-like part **71**.

Referring back to FIG. **2**, connection parts **75** are disposed between tube-like part **71** and first radiation fins **74***a*. In each of connection parts **75**, hole **77** is disposed to allow screw **90** to pass therethrough.

Rim part **76** connects outer edges of radiation fins **74**. Rim part **76** plays a role in enhancing mechanical strength of the plurality of radiation fins **74**. In addition, rim part **76** serves as a hand grip for a user, either in attaching illumination light source **1** to a lighting fixture (not shown) or in rotating radiation member **50**.

Second radiation member **80** includes rotary ring body **84**, projections **81**, and reduced-inner-diameter ring part **83** (for reduced-inner-diameter ring part **83**, see the inserted cross-sectional view of X-portion in the Figure). Rotary ring body **84** is substantially cylindrical. On one end part of rotary ring body **84**, a pair of projections **81** is formed. In each of projections **81**, screw hole **82** is formed. On the other end part of rotary ring body **84**, reduced-inner-diameter ring part **83** is formed which extends toward the center axis.

Here, the inner diameter of rotary ring body **84** is larger than the outer diameter of large-diameter part **31** of case **30**, while the inner diameter of reduced-inner-diameter ring part **83** is larger than the outer diameter of small-diameter part **32** of case **30**. Rotary ring body **84** is assembled such that its inner wall surrounds the outer wall of large-diameter part **31** of case **30**. In assembling of illumination light source **1**, the base **40** side of case **30** is first inserted from one end of second radiation member **80**, and then large-diameter part **31** of case **30** is fitted into rotary ring body **84** of second radiation member **80**. Then, first radiation member **70** is arranged to overlap with second radiation member **80**, and projections **81** of second radiation member **80** are caused to abut on connection parts **75** of first radiation member **70**. After that, screws **90** are passed through holes **77** of connection parts **75**, and then screws **90** are screwed into screw holes **82** of projections **81**. In this way, first radiation member **70** and second radiation member **80** are combined into a one-piece body, i.e. radiation member **50**.

(Cover)

Cover **60** is a disk-like member for covering the opening of tube-like part **71**, which is operative to diffuse the light emitted from light emitting module **10**, thereby adjusting light distribution characteristics of illumination light source **1**. Cover **60** is formed with a translucent material including, for example, a glass and a resin material such as an acryl or a polycarbonate resin.

[Rotation Mechanism]

The rotation mechanism of illumination light source **1** will be described. FIG. **4** is a partial cross-sectional view of illumination light source **1**. As shown in the inserted enlarged view of Z-portion in the Figure, one surface **83***a* of reduced-inner-diameter ring part **83** of radiation member **50** is positioned to face end surface **31***a* of large-diameter part **31** of case **30**, which thereby prevents case **30** from falling off. In addition, one surface **72***b* of bottom plate **72** of radiation member **50** is positioned to face end surface **31***b* of large-diameter part **31**. In this way, large-diameter part **31** is sandwiched between reduced-inner-diameter ring part **83** and bottom plate **72**, which thereby prevents radiation member **50** from moving relative to case **30** in both directions of center axis J.

Moreover, both rotary ring body **84** of second radiation member **80** and large-diameter part **31** of case **30** are substantially cylindrical. The rotation axis of rotary ring body **84** is agreeing with center axis J of large-diameter part **31**. Then, both the inner diameter of rotary ring body **84** and the outer diameter of large-diameter part **31** are set to yield a slight clearance between the inner peripheral surface of rotary ring body **84** and the outer wall of large-diameter part **31**. This allows radiation member **50** to rotate about the center axis of large-diameter part **31**. With this configuration, radiation member **50** is rotatably held relative to case **30**. That is, the rotation mechanism is adopted between radiation member **50** and case **30**.

It is noted that, on bottom plate **72** of radiation member **50**, restriction part **78** is formed to restrict the rotation, as shown in FIG. **4**. The outer side part of one end of large-diameter part **31** of case **30** includes stepped part **38** which has an outer diameter slightly smaller than that of large-diameter part **31**. On stepped part **38**, stopper **37** is formed to restrict the allowable range of rotation of radiation member **50**. Illumination light source **1** is provided with one restriction part **78** and one stepped part **38**. With this configuration, the number of rotation of radiation member **50** relative to case **30** is restricted to be smaller than one.

[Modes of Use of Illumination Light Source]

FIGS. **5**A to **5**D are views of an exemplified mode of use of illumination light source **1**. Throughout these figures, the downward direction on the paper sheets of the views refers to the vertically downward direction. FIG. **5**A shows the state before illumination light source **1** is attached to lighting fixture **95**. In this example, lighting fixture **95** is mounted to wiring duct **96** installed on a ceiling or the like. Moreover, the orientation of lighting fixture **95** can be freely changed.

FIG. **5**B shows the state where base **40** of illumination light source **1** is being screwed into socket **97**. The user grasps rim part **76** of radiation member **50** with user's hand, and applies a clockwise force to radiation member **50**. This causes radiation member **50** to rotate relative to case **30**. Then, restriction **78** of radiation member **50** comes in contact with stopper **37** of case **30**, which thereby conveys the clockwise force applied to radiation member **50** to case **30**, resulting in the rotation of case **30** together with radiation member **50** as an integral whole. With this configuration, base **40** is screwed into socket **97**. It is noted that, alternatively, case **30** may be grasped to directly apply the clockwise force to case **30**, which thereby screws base **40** into socket **97**.

FIG. **5**C shows the state where the orientation of the plurality of radiation fins **74** is being adjusted. After base **40** has been screwed into socket **97**, the user then applies a counterclockwise force to radiation member **50** so as to cause radiation member **50** to rotate relative to case **30**.

FIG. **5**D shows the state after the orientation of the plurality of radiation fins **74** has been adjusted. In the state, the adjustment is made such that the plate surfaces of all radiation fins **74** are oriented along the vertical direction. In this way, even after illumination light source **1** has been mounted with center axis J of case **830** being at an inclination relative to the vertical direction, the plate surfaces of radiation fins **74** can be oriented along the vertical direction, by rotating radiation member **50** about center axis J of case **830**.

Here, the rotation torque required for the counterclockwise rotation of radiation member **50** relative to case **30**, is adjusted to be smaller than the rotation torque required for the counterclockwise rotation of illumination light source **1** to remove the light source from socket **97** of lighting fixture **95** where the light source is mounted to the socket. For this reason, as shown in FIG. **5**C, even when radiation member **50** is applied with the counterclockwise force to cause radiation member **50** to rotate relative to case **30**, base **40** does not rotate relative to socket **97**, retaining the state of being mounted to socket **97**.

For example, in the case where the diameter of base **40** is 26 mm (E26 base) or 27 mm (E27 base), the rotation torque required for removing base **40** from socket **97** is larger than 5.0 Nm. Therefore, in this case, the rotation torque required for rotating radiation member **50** relative to case **30** may be set not smaller than 0.5 Nm and not larger than 5.0 Nm. Moreover, in the case where the diameter of base **40** is 12 mm (E12 base), 14 mm (E14 base), or 17 mm (E17 base), the rotation torque required for removing base **40** from socket **97** is larger than 1.5 Nm. Therefore, in this case, the rotation torque required for rotating radiation member **50** relative to case **30** may be set not smaller than 0.5 Nm and not larger than 1.5 Nm.

The rotation torque required for rotating radiation member **50** relative to case **30** can be set by adjusting, for example, the coefficient of friction between the outer wall of large-diameter part **31** of case **30** and the inner peripheral surface of rotary ring body **84** of radiation member **50**. The coefficient of friction between the outer wall of large-diameter part **31** and the inner peripheral surface of rotary ring body **84**, can be changed by adjusting the factors including, for example: The degree of adhesion between the outer wall of large-diameter part **31** and the inner peripheral surface of rotary ring body **84**; the area where the outer wall of large-diameter part **31** faces the inner peripheral surface of rotary ring body **84**; the materials of large-diameter part **31** and rotary ring body **84**; and the material of lubricant applied between the outer wall of large-diameter part **31** and the inner peripheral surface of rotary ring body **84**.

[Advantages]

Hereinafter, advantages of illumination light source **1** will be described in comparison with Comparative Examples. Here, the description is made for the case where illumination light source **1** is mounted, with center axis J being set in the direction perpendicular to the vertical direction.

FIGS. **6**A and **6**B are views of illumination light source **1**, which illustrate air streams during lighting-up of the light source. In the Figures, the downward direction on the paper sheets of the views refers to the vertically downward direction.

During the lighting-up of illumination light source **1**, the heat is generated by light emitting module **10** which warms the air around illumination light source **1**. As a result, air streams F**0**, F**1**, F**2**, and F**3** occur which flow vertically upward. Because the plate surfaces of radiation fins **74***a* and **74***b* are along the vertical direction, the plate surfaces do not interfere with the air streams flowing vertically upward. For example, as shown in FIG. **6**B, air streams F**0**, F**1**, and F**3** can smoothly flow because the plate surfaces of radiation fins **74***b*, located on both sides of the air streams, are along the vertical direction. Moreover, air streams F**0** and F**1** are not interfered with by the outer wall of tube-like part **71**, where air stream F**0** flows through a gap between first radiation fins **74***a* and air stream F**1** flows through a gap between first radiation fin **74***a* and second radiation fin **74***b*. For this reason, the warmed air does not stagnate in the gaps between first radiation fins **74***a* and the gaps between first radiation fins **74***a* and second radiation fins **74***b*. As a result, it is possible to efficiently radiate the heat generated from light emitting module **10**.

FIG. **7** is a view of illumination light source **100** of a Comparative Example, which illustrates air streams during lighting-up of the light source. Illumination light source **100** is different from illumination light source **1** in that a plurality of flat-plate radiation fins **140** is radially disposed on the outer wall of tube-like part **71**. In the Figure, the downward direction on the paper sheet of the view refers to the vertically downward direction.

Both radiation fin **140***a* and radiation fin **140***b* are disposed at locations substantially vertically downward relative to the outer wall of tube-like part **71**. Air stream F**4**, which flows into a gap between radiation fin **140***a* and radiation fin **140***b* disposed at the locations, is interfered with by the outer wall of tube-like part **71**. For this reason, the air warmed via the heat exchange with radiation fin **140***a* and radiation fin **140***b*, is caused to stagnate in the gap between radiation fin **140***a* and radiation fin **140***b* (Cloud symbol S**2**).

When air flows into a gap between radiation fin **140***c* and radiation fin **140***d*, air stream F**5** is necessary which has to climb over radiation fin **140***c* to flow into the gap. Therefore, it is difficult for the air to flow into the gap between radiation fin **140***c* and radiation fin **140***d*. Moreover, the stream of air warmed via the heat exchange is interfered with by the plate surface of radiation fin **140***d*. For this reason, the air warmed via the heat exchange is caused to stagnate in the gap between radiation fin **140***c* and radiation fin **140***d* (Cloud symbol S3).

Moreover, when the air flows out from a gap between radiation fin **140***e* and radiation fin **140***f*, air stream F**6** is necessary which has to climb over radiation fin **140***f* to flow out. Therefore, it is difficult for the air to flow out from the gap between radiation fin **140***e* and radiation fin **140***f*.

As described above, illumination light source **1** includes light emitting module **10**, circuit unit **20**, base **40**, case **30** (the first housing member), and radiation member **50** (the second housing member). Light emitting parts **12** are electrically coupled with circuit unit **20**. Circuit unit **20** is electrically coupled with base **40**. Case **30** has a tube-like shape, and accommodates circuit unit **20**. Tube-like case **30** includes the openings at both ends thereof, and includes the light emitting module disposed in one of the openings and the base disposed in the other.

Radiation member **50** includes rotary ring body **84** and the plurality of plate-like radiation fins **74**. Rotary ring body **84** has the rotation axis agreeing with center axis J of case **30**. Plate-like radiation fins **74** are in parallel with one virtual plane A containing the rotation axis, and are disposed at intervals between each other in direction B orthogonal to plane A. In the combination of radiation member **50** and case **30**, radiation member **50** is combined with case **30** such that the inner wall of rotary ring body **84** surrounds the outer wall of case **30**. That is, radiation member **50** is rotatably attached to case **30**, about center axis J.

It is noted that the rotation mechanism of radiation member **50** rotatable about center axis J may be adopted between radiation member **50** and case **30**, as in the case of illumination light source **1**. Alternatively, the rotation mechanism may be adopted in at least one of case **30** and radiation member **50**.

In accordance with the configuration, even when illumination light source **1** is mounted at an inclination relative to the vertical direction, the plate surfaces of radiation fins **74** can be oriented along the vertical direction by rotating radiation member **50** about center axis J of case **30**. This configuration permits a smooth flow of the warmed air. As to first radiation fins **74***a*, in particular, the air stream is not interfered with by the outer wall of tube-like part **71**, which results in no stagnation of the warmed air, leading to the efficient heat exchange.

Note that, as shown in FIG. **6**B, in illumination light source **1**, second radiation fins **74***b* are disposed on the outer wall of tube-like part **71**. With this configuration, air stream F**2** which passes through a gap between second radiation fins **74***b* is interfered with by the outer wall of tube-like part **71**. Therefore, the air warmed via the heat exchange with second radiation fins **74***b* is caused to stagnate in the gap between second radiation fins **74***b* (Cloud symbol S1). However, illumination light source **1** has a small amount of the space where such air-stagnation occurs, compared to illumination light source **100** of the Comparative Example. For this reason, illumination light source **1** has superiority in heat radiation over illumination light source **100** of the Comparative Example.

In illumination light source **1**, the allowable number of rotation of radiation member **50** is restricted to be smaller than one. This can prohibit radiation member **50** from excessively rotating relative to case **30**, thereby preventing disconnection of lead wires **24** from connection terminals **13** and connection terminals **23**, and preventing breaking of lead wires **24**.

The fin-surface area of each of radiation fins **74** is set to become smaller, with increasing the-center-to-fin distance in the direction orthogonal to plane A. This configuration renders illumination light source **1** similar in appearance to a halogen lamp (see FIG. **1**). In addition, each of the gaps between radiation fins **74** is set to become narrower, with increasing the-center-to-fin distance in direction B orthogonal to plane A. This configuration secures a certain level of the heat radiation performance even at a location far away from plane A, i.e. the location where the areas of radiation fins **74** are small.

Radiation fins **74** are thermally coupled with each other via connection parts **75** and rim part **76**, which allows heat transfer among radiation fins **74**. Therefore, the heat generated by light emitting module **10** and the like is capable of dispersing over all of radiation fins **74** without uneven distribution in a part of radiation fins **74**, resulting in the efficient heat exchange with outside air.

As shown in FIG. **2**, the rotation axis of tube-like part **71** is agreeing with center axis J of case **30**. Moreover, the plurality of light emitting parts **12** disposed on the upper surface of mounting substrate **11** is formed in a loop around the center axis of tube-like part **71**. On light emitting module **10**, it is the loop area that mainly emits light. Accordingly, even if radiation member **50** is rotated about center axis J of case **30**, the area mainly emitting the light remains unchanged, on light emitting module **10**. As a result, before and after the rotation of radiation member **50**, there is no significant difference in light distribution characteristics of the light emitted from illumination light source **1**.

Next, descriptions will be made regarding illumination light source **200** of the embodiment, with reference to FIGS. **8** and **9**. In illumination light source **1**, radiation member **50** is disposed around the peripheral part of light emitting module **10**. Instead of this, in illumination light source **200**, radiation member **250** is disposed around the cylindrical part of case **230** which accommodates circuit unit **20**. FIG. **8** is a perspective view of an appearance configuration of illumination light source **200**. FIG. **9** is a cross-sectional side-elevation view of illumination light source **200**. Illumination light source **200** includes light emitting module **10**, circuit unit **20**, case **230**, base **40**, radiation member **250**, and cover **260**. Case **230** serves as the first housing member. Radiation member **250** serves as the second housing member.

Illumination light source **200** is slightly different from illumination light source **1** in the structure of case **230**. As shown in FIG. **9**, case **230** is a tube-like body with center axis J, and includes light transmission member **231**, first tube-like body **232**, second tube-like body **233**, and mounting plate **234**.

Light transmission member **231** is configured with a translucent material such as a glass or a plastic material. The inner peripheral surface of light transmission member **231** is formed as a dichroic mirror composed with a deposited substance such as titanium. The dichroic mirror reflects light with a specific range of wavelengths to the front side of light transmission member **231** on the one hand, and passes light with the other range of wavelengths therethrough to the lateral outside of light transmission member **231** on the other hand.

Light emitting module **10** is mounted on mounting plate **234**. In mounting plate **234**, annular ring-like groove **235** is formed to surround light emitting module **10**. One-end opening part **236** of light transmission member **231** is inserted into groove **235** to be joined with mounting plate **234** with an adhesive (not shown) charged in groove **235**.

In second tube-like body **233**, as shown in FIG. **9**, small-diameter part **237** with a predetermined diameter is formed at the body's end portion located opposite to base **40**. From the end of the small-diameter part, claws **239** protrude in the direction opposite to base **40**. Although only two of claws **239** are shown in FIG. **9**, three claws **239** are actually disposed at regular intervals on the circumference of small-diameter part **237**.

As shown in FIG. **8**, in illumination light source **200** as in the case of illumination light source **1**, a plurality of radiation fins **252** which is arranged in parallel with each other is disposed on the outer wall of rotary ring body **251**, i.e. the tube-like part. Of the plurality of radiation fins **252** excluding radiation fins **252*a*** located at both ends, each of radiation fins **252*b*** is disposed to protrude from the outer wall of rotary ring body **251**. Radiation fins **252*a*** at both ends are disposed on rotary ring body **251** via connection parts **253**, at locations outward away from the circumferential surface of rotary ring body **251**. Rotary ring body **251** is rotatably fitted onto small-diameter part **237** of second tube-like body **233** of case **230**.

It is only three of claws **239** that are disposed on the circumference of small-diameter part **237** of second tube-like body **233** shown in FIG. **9**. This number of three renders the claws capable of being bent inward when first tube-like body **232** is fitted into small-diameter part **237**, which is operative to increase the workability of assembling of radiation member **250**.

Onto small-diameter part **237**, one end of first tube-like body **232** is fitted together with rotary ring body **251**. On the inner peripheral surface of the one end of first tube-like body **232**, projected rim **232*a*** is formed. Onto projected rim **232*a***, claws **239** are fitted to fix first tube-like body **232** to second tube-like body **233**. It is noted, however, that the diameter of projected rim **232*a*** is smaller than that of small-diameter part **237**, which causes projected rim **232*a*** to abut on small-diameter part **237**, thereby restricting the rotation of first tube-like body **232** relative to second tube-like body **233**.

In illumination light source **200**, radiation member **250** is disposed around the cylindrical part of case **230** with a substantially cylindrical shape, whereas radiation member **250** is not disposed around the axis of light transmission member **231**. This configuration allows the light having passed through the side surface of light transmission member **231** to travel to the outside.

Moreover, in illumination light source **200**, even when case **230** is attached at an inclination relative to the vertical direction, all radiation fins **252** can be arranged to orient their plate surfaces in the direction along the vertical direction, by rotating radiation member **250** about center axis J of case **230**. It is noted that, in illumination light source **200**, since light emitting module **10** is fixed to case **230**, the rotation of radiation member **250** relative to case **230** does not cause light emitting module **10** to rotate. For this reason, before and after the rotation of radiation member **250**, the distribution characteristics of the light emitted from illumination light source **200** remains unchanged.

Next, illumination light source **300** according to the embodiment will be described with reference to FIG. **10**. FIG. **10** is a perspective cross-sectional view of illumination light source **300**. Case **330** serves as the first housing member. Radiation member **350** serves as the second housing member. Illumination light source **300** is different from illumination light source **1**, in the location of the rotation mechanism.

Specifically, in illumination light source **1**, the rotation mechanism is adopted between radiation member **50** and case **30** that accommodates circuit unit **20**. In contrast, in illumination light source **300**, case **330** is configured with two members, i.e. first case member **370** and second case member **380**, and the rotation mechanism is adopted between first case member **370** and second case member **380**. That is, the rotation mechanism is adopted in case **330**.

As shown in FIG. **10**, case **330** of illumination light source **300** includes cone-shaped first case member **370** and tube-like second case member **380**.

First case member **370** is mounted to a lighting fixture (not shown) via base **40** that is attached to the end part of the case member.

Onto the outer periphery of second case member **380**, tube-like rotary ring body **353** is fitted which is formed at one end of radiation member **350**. The outer wall of second case member **380** is fastened, with an adhesive, to the inner peripheral surface of rotary ring body **353**, thereby fixing radiation member **350** to case **330**.

The connection portion between first case member **370** and second case member **380** is as follows: That is, claws **383** are formed to protrude from a one-end peripheral surface of second case member **380** (Although only two of claws **383** are shown in FIG. **10**, three claws are actually formed). Claws **383** are inserted into reduced-inner-diameter ring part **371** that is formed in a one-end peripheral surface of first case member **370**, thereby locking second case member **380** on first case member **370**. By appropriately forming both the outer diameter of claws **383** and the inner diameter of reduced-inner-diameter ring part **371**, it allows the rotatable coupling between first case member **370** and second case member **380**. With this configuration, both radiation member **350** and second case member **380** are rotatable with respect to first case member **370** that is mounted to the lighting fixture (not shown).

Note that, on the outer wall of reduced-inner-diameter ring part **371**, stopper **372** is formed to restrict the allowable range of rotation of second case member **380**, thereby restricting the allowable range of rotation of radiation member **350**.

Moreover, both first case member **370** and second case member **380** of case **330** are configured with a resin to render the both capable of bending flexibly when being coupled with each other, resulting in an increase in ease of the assembling work.

Next, illumination light source **400** according to the embodiment will be described with reference to FIGS. **11** and **12**. Case **430** serves as the first housing member. Radiation member **450** serves as the second housing member. Illumination light source **400** is different from illumination light source **1** in the mechanism to restrict the movement of radiation member **450** in both directions of center axis J. In illumination light source **1**, the movement of radiation member **50** in both directions of center axis J is restricted by sandwiching large-diameter part **31** of case **30** by radiation member **50** configured with the first radiation member and the second radiation member. In contrast, the movement of radiation member **450** is restricted in both directions of center axis J, by sandwiching radiation member **450** by both cover **470** and large-diameter part **432** of case **430**.

FIG. **11** is an exploded perspective view of each of members which configure illumination light source **400**. Illumination light source **400** includes light emitting module **10**, circuit unit **20**, case **430**, base **40**, light-source accommodating part **440**, radiation member **450**, and cover **470**.

As can be seen from the Figure, radiation member **450** is an integrally-molded article, and tube-like rotary ring body **451** at the center of the radiation member is rotatably fitted onto both case **430** and light-source accommodating part **440** (see FIG. **12**).

In case **430**, small-diameter part **431** is formed having a predetermined length starting from the one end opposite to base **40**. The outer diameter of small-diameter part **431** is approximately agreeing with the outer diameter of light-source accommodating part **440**.

Cover **470** is a disk-like member to cover an opening of light-source accommodating part **440**. On cover **470**, a plurality (three in the embodiment) of locking projections **471** is formed. Locking projections **471** are respectively fitted into recesses **441** that are formed in the inner peripheral surface of light-source accommodating part **440**, thereby fixing cover **470** to light-source accommodating part **440**.

When illumination light source **400** is assembled, firstly, screws **490** are inserted into holes (not shown in FIG. **11**) that are formed in a peripheral part of the bottom wall of light-source accommodating part **440**. Then, screws **490** are screwed into screw holes **433** that are formed in the end surface of case **430**, thereby fixing light-source accommodating part **440** to case **430**. Then, radiation member **450** is inserted from one end of light-source accommodating part **440** such that radiation member **450** is fitted onto both small-diameter part **431** of case **430** and the outer side of light-source accommodating part **440**. After that, locking projections **471** of cover **470** are fitted into recesses **441** of light-source accommodating part **440**, thereby fixing cover **470** to light-source accommodating part **440**.

FIG. **12** is a cross-sectional view of illumination light source **400**. As shown in the inserted enlarged view of N-portion in the Figure, end surface **451*b*** of radiation member **450** faces end surface **432*a*** of large-diameter part **432** of case **430**. Moreover, as shown in the inserted enlarged view of M-portion in the Figure, end surface **451*a*** of radiation member **450** faces end surface **470*a*** of cover **470**. In this way, since radiation member **450** is sandwiched between cover **470** and large-diameter part **432** of case **430**, the movement of radiation member **450** is restricted in both directions of center axis J relative to case **430**.

It is noted that, on the inner peripheral surface of rotary ring body **451** of radiation member **450**, one restriction part **452** is formed to restrict the rotation. On the other hand, on an end part of light-source accommodating part **440**, one stopper **37** is formed to restrict the allowable range of rotation of radiation member **450**. With this configuration, the allowable range of rotation of radiation member **450** is restricted, at the location different from that in illumination light source **1**.

Next, illumination light source **500** according to the embodiment will be described, with reference to FIGS. **13** and **14**. Case **30** serves as the first housing member, while radiation member **550** serves as the second housing member. Illumination light source **500** is different from illumination light source **1** in that pass-through parts for ventilation are formed in some of the radiation fins.

FIG. **13** is a perspective view of illumination light source **500**. Illumination light source **500** includes first radiation fins **74*a***, second radiation fins **74*b***, and third radiation fins **74*c***. In third radiation fins **74*c***, pass-through parts **570** for ventilation are formed to pass air from first principal faces **741** to second principal faces **742**. That is, of the plurality of the radiation fins, at least one of the radiation fins is provided with pass-through part **570**.

As shown in the elevational view of FIG. **14**, when it is assumed that boundary plane C refers to a virtual plane which includes center axis J and is orthogonal to plane A, there are two regions which are disposed on the outer wall of tube-like part **71** and are partitioned by boundary plane C. With this assumption, third radiation fins **74***c* are present only in one of the two regions.

In illumination light source **500**, when the orientation of the radiation fins is adjusted such that third radiation fins **74***c* are located on the vertically lower side, air streams F**7** occur which pass through pass-through parts **570**, in addition to the air streams in illumination light source **1**. Specifically, after each of air streams F**2** passing through between third radiation fins **74***c* has impinged against the outer wall of tube-like part **71**, the air stream passes through pass-through part **570** to merge with air stream F**1** passing through between first radiation fin **74***a* and third radiation fin **74***c*. With this configuration, it is possible to suppress the occurrence of the air stagnation indicated by Cloud symbol S**1** of FIG. **6**B.

Next, illumination light source **600** according to the embodiment will be described with reference to FIG. **15**. Case **30** serves as the first housing member, while radiation member **650** serves as the second housing member. Illumination light source **600** is different from illumination light source **500** in that thicknesses of some of the plurality of the radiation fins are different from those of the other radiation fins.

FIG. **15** is a perspective view of illumination light source **600**. Illumination light source **600** includes first radiation fins **74***a*, second radiation fins **74***b*, third radiation fins **674***c*, and fourth radiation fin **674***b*. Third radiation fins **674***c* are identical to third radiation fins **74***c* in illumination light source **500**, except that their thicknesses are made larger. In addition, fourth radiation fin **674***b* is identical to second radiation fin **74***b* in illumination light source **500**, except that its thickness is made larger.

In order for pass-through parts **570** to play a role in suppressing the air stagnation, the orientation of the radiation fins is required to be adjusted such that the radiation fins having pass-through parts **570** are located on the vertically lower side. However, when pass-through parts **570** are merely formed in the radiation fins, it causes the radiation fins having pass-through parts **570** to become light in weight. This causes a shift of the center of gravity of radiation member **650** out of the center axis, toward the direction opposite to the direction in which pass-through parts **570** are formed. For this reason, when the orientation of the radiation fins is adjusted such that the radiation fins having pass-through parts **570** are located on the vertically lower side, the center of gravity of radiation member **650** comes to a location vertically upward from the center axis. With this configuration, in case illumination light source **600** should be subjected to an impact of something or vibrations from something, there is a possibility that the radiation member rotates to change the orientation of the radiation fins, due to the displacement of the center of gravity as describe above.

Consequently, in illumination light source **600**, the thicknesses of third radiation fins **674***c* and fourth radiation fin **674***b* are made larger, which are located in a region where pass-through parts **570** are formed. With this configuration, in plane A, the position of the center of gravity of radiation member **650** is shifted from rotation axis J toward the direction in which fourth radiation fin **674***b* with the larger thickness is located. That is, the center of gravity of radiation member **650** is located in a region on one side away from rotation axis J, in plane A. For this reason, after a user has adjusted the orientation of the radiation fins such that third radiation fins **674***c* are located on the vertically lower side, there is a remote possibility that the radiation fins will change the orientation on their own accord.

Moreover, in the case where a lubricant such as grease or lubricating oil is applied to reduce the coefficient of friction between radiation member **650** and case **30**, when illumination light source **600** is mounted at an inclination relative to the vertical direction, radiation member **650** rotates on its own about center axis J relative to case **30**, due to the displacement of the center of gravity of radiation member **650**. Then, at a time when the line connecting between center axis J and the center of gravity comes to point toward the vertical direction, radiation member **650** terminates its rotation. At this time, the plate surfaces of radiation fins **74***a*, **74***b*, **674***c*, and **674***b* are along the vertical direction. In addition, third radiation fins **674***c* are located on the vertically lower side. In this way, there is no need for the user to perform the adjustment of illumination light source **600** for a better efficiency, which provides greater convenience for the user.

It is noted, however, that techniques other than the use of lubricant may be employed to reduce the coefficient of friction between radiation member **650** and case **30**. For example, a bearing may be disposed between radiation member **650** and case **30** to reduce the coefficient of friction between radiation member **650** and case **30**.

Next, illumination light source **700** according to the embodiment will be described with reference to FIGS. **16** to **17**B. Case **30** serves as the first housing member, while radiation member **750** serves as the second housing member. Illumination light source **700** is different from illumination light source **1** in the structure of the radiation member. Specifically, in the plates of some of the radiation fins, light-through holes are formed to pass the light emitted from the light emitting module.

FIG. **16** is a perspective view of illumination light source **700**. In first tube-like part **701** of radiation member **750**, a plurality of first light-through holes **702***a* is formed to pass the light emitted from light emitting module **10**. Into first tube-like part **701**, translucent cap **703** is fitted. Cap **703** covers light emitting module **10** to prevent the entry of foreign substances including water into emitting module **10**.

In the plates of first radiation fins **74***a* of radiation member **750**, a plurality of second light-through holes **702***b* is formed to pass the light emitted from light emitting module **10**, after the light has passed through first light-through holes **702***a* of first tube-like part **701**.

As shown in FIG. **17**A, when illumination light source **700** is viewed from the direction parallel to the radiation fins, first light-through holes **702***a* of first tube-like part **701** can be observed through between second radiation fins **74***b*. This means that part of the light emitted from light emitting module **10** can pass through first light-through holes **702***a*, and further through between second radiation fins **74***b* to travel to the outside. That is, in first tube-like part **701**, first light-through holes **702***a* are each formed between adjacent two radiation fins **74***b* of the plurality of second radiation fins **74***b*, in the direction of traveling of the light emitted from emitting part **12**.

On the other hand, as shown in FIG. **17**B, first light-through holes **702***a* of first tube-like part **701** are shielded by the plate surfaces of first radiation fins **74***a*, thereby being unable to be observed when viewed from the direction perpendicular to the radiation fins, unless any action is taken against the problem. Therefore, the light emitted from light emitting part **12** is blocked by the plate surfaces of first radiation fins **74***a*.

To address this problem, in illumination light source **700**, there is formed a plurality of light-through parts **704** in the plates of first radiation fins **74***a* so as to pass the light emitted from light emitting module **10**. Through light-through parts **704**, first light-through holes **702***a* of first tube-like part **701** can be observed. Consequently, it makes it possible to allow the light, emitted in the direction in which first radiation fins **74***a* are disposed, to travel to the outside. As a result, it is possible to increase the amount of the light emitted from the side surface of illumination light source **700** to the outside. That is, in first radiation fins **74***a* located in direction B from the rotation axis, second light-through holes **702***b* are formed in the direction of traveling of the light emitted from light emitting part **12**.

MODIFIED EXAMPLES

It should be noted that, although the descriptions have been made based on the various embodiments described above, the present disclosure is obviously not limited to the various embodiments. The following cases are also within the scope of the present disclosure. Note, however, that constituent elements common to illumination light source **1** are designated by the same numerals and symbols as those of illumination light source **1**, and their descriptions will be simplified or omitted.

In the various embodiments, the descriptions have been made for the examples where the mechanism to restrict the allowable range of rotation of the radiation member is adopted in the radiation member and the case; however, the present disclosure is not necessarily limited to the examples. For example, instead of the aforementioned mechanism to restrict the allowable range of the rotation, a mechanism may be adopted which restricts the rotational direction of the radiation member to one-way only.

FIG. **18** is a partial cross-sectional view of illumination light source **800** of Modified Example 1. In an end part of large-diameter part **831** of case **830**, gear **801** is disposed. The tooth flank of each of the teeth of gear **801** includes slope part **802** and step part **803**.

FIG. **19** is a cross-sectional view of illumination light source **800**, taken along a plane orthogonal to center axis J of case **30**. On the inner peripheral surface of second member **880** of radiation member **850**, pawl part **804** is disposed which is configured with an elastic body such as resin. In the inner peripheral surface of second member **880**, recess **851** is formed. Fit-in piece **805** of pawl part **804** is fastened, with an adhesive, with the fit-in piece fitting into recess **851**, which results in the fixation of pawl part **804** to second member **880**.

Projection piece **806** of pawl part **804** is disposed at an inclination, in a plan view, relative to the direction orthogonal to the inner peripheral surface of second member **880**. As shown in the inserted enlarged view of Y-portion in the Figure, when second member **880** is applied with a counterclockwise force (arrow K), projection piece **806** comes in contact with slope part **802** of gear **801** to bend toward the direction of arrow L, thereby climbing over slope part **802** of gear **801**. Therefore, radiation member **850** can move in the counterclockwise direction. In contrast, when second member **880** is applied with a clockwise force, projection piece **806** engages with step part **803** of gear **801**. As a result, radiation member **850** cannot move in the clockwise direction. That is, in the rotation mechanism, gear **801** and pawl part **804** serve as the restriction part to restrict the rotation.

In this way, because the rotation of radiation member **850** is restricted only to the counterclockwise rotation, the clockwise force applied to radiation member **850** is conveyed to case **30**. For this reason, when the user screws base **40** of illumination light source **800** into socket **97**, the user is required to apply a clockwise force to radiation member **850**.

On the other hand, when adjusting the orientation of radiation fins **74**, the user is required to apply a counterclockwise force to radiation member **850**.

In the various embodiments described above, the descriptions have been made for the examples where the light emitting module is electrically coupled with the circuit unit by using the lead wires that connect between the connection terminals of the light emitting module and the connection terminals of the circuit unit. However, the present disclosure is not necessarily limited to the examples. For example, a slip-ring mechanism may be adopted to provide the electrical coupling between the connection terminals of the light emitting module and the connection terminals of the circuit unit.

FIG. **20** is a partial cross-sectional view of illumination light source **900** of Modified Example 2. FIG. **21** is a cross-sectional, side-elevational view of illumination light source **900**. Above case **30** to accommodate circuit unit **20** and below bottom plate **72** to mount light emitting module **10** thereon, electric connecting plates **921***a* and **921***b* are disposed, respectively.

On principal faces on one sides of electric connecting plates **921***a* and **921***b*, a pair of first conduction paths **922***a* and **922***b* is formed, respectively, and a pair of second conduction paths **923***a* and **923***b* is formed, respectively. First conduction paths **922***a* and **922***b* each have a round shape, and are respectively disposed on the centers of the electric connecting plates. Second conduction paths **923***a* and **923***b* each have an annular-ring shape, and are respectively disposed concentrically about the centers of the electric connecting plates. Moreover, on principal faces on the other sides of electric connecting plates **921***a* and **921***b*, a pair of third conduction paths **924***a* and **924***b* is formed, respectively, and a pair of fourth conduction paths **925***a* and **925***b* is formed, respectively. Third conduction paths **924***a* and **924***b* each have a round shape, and are electrically connected with the pair of conduction paths **922***a* and **922***b*, respectively. Fourth conduction paths **925***a* and **925***b* each have a round shape, and are electrically connected with the pair of second conduction paths **923***a* and **923***b*, respectively.

Third conduction path **924***a* of electric connecting plate **921***a* is coupled with first connection terminal **23***a* of circuit unit **20**. In addition, fourth conduction path **925***a* of electric connecting plate **921***a* is coupled with second connection terminal **23***b* of circuit unit **20**. For example, first connection terminal **23***a* is a negative pole, while second connection terminal **23***b* is a positive pole.

On the other hand, third conduction path **924***b* of electric connecting plate **921***b* is coupled with first connection terminal **13***a* of light emitting module **10**. In addition, fourth conduction path **925***b* of electric connecting plate **921***b* is coupled with second connection terminal **13***b* of light emitting module **10**. For example, first connection terminal **13***a* is a negative pole, while second connection terminal **13***b* is a positive pole.

Electric connecting plates **921***a* and **921***b* are disposed to face each other. In the state of radiation member **50** being fitted onto case **30**, first conduction path **922***a* is in contact with first conduction path **922***b*, while second conduction path **923***a* is in contact with second conduction path **923***b*.

Even when radiation member **50** is rotated about center axis J relative to case **30**, it is possible to retain both the electrical connections, i.e. the connection between first conduction path **922***a* and first conduction path **922***b* and the connection between second conduction path **923***a* and second conduction path **923***b*. That is, this configuration forms the slip-ring mechanism which brings about the electric connection between case **30** fixed to the lighting fixture (not shown) and radiation member **50** rotatable relative to case **30**. That is, a pressure causes first conduction paths **922***a* and **922***b* to be in contact with each other, and second conduction paths **923***a* and **923***b* to be in contact with each other.

In illumination light source **900**, because of the adoption of the slip-ring mechanism described above, there is no possibility of disconnection and breakage of the lead wires, even when radiation member **50** is rotated relative to case **30**. Accordingly, light emitting module **10** can stably receive power supply from circuit unit **20**.

A mark to indicate the direction in which the radiation fins are preferably oriented may be disposed in the illumination light source. FIG. **22** is a perspective view of illumination light source **1000** of Modified Example 3. In the case shown in the Figure, marks **1000** and **1002** to indicate the direction in which radiation fins **74** are preferably oriented are disposed in rim part **76**. In the Figure, "U" means the vertically upward direction (UP), while "D" means the vertically downward direction (DOWN). Marks **1000** and **1002** let the user know the direction in which radiation fins **74** are preferably oriented.

In illumination light source **500** shown in FIG. **13**, the descriptions have been made for the examples where the pass-through parts are disposed in a specific plurality of the fins, among the plurality of the radiation fins. That is, the specific plurality of the fins are ones that are disposed on the outer wall of the tube-like part and that are present in one of the two regions partitioned by boundary plane C. However, the present disclosure is not necessarily limited to the examples. The pass-through parts may be disposed in the radiation fins present on plane A. Moreover, the pass-through parts may be disposed in the radiation fins present in the other of the two regions partitioned by boundary plane C.

In illumination light source **600** shown in FIG. **15**, the descriptions have been made for the examples where the location of the center of gravity of the second housing member is adjusted to be out of the center axis, by increasing the thicknesses of the plates of some of the plurality of the radiation fins. However, the present disclosure is not necessarily limited to the examples. For example, the location of the center of gravity of the second housing member may be adjusted to be out of the center axis, in plane A, by changing the weights or the like of the other parts of the second housing member.

In the various embodiments described above, the descriptions have been made for the examples where the bases are Edison-type screw bases. However, the present disclosure is not necessarily limited to the examples. For example, the base may be a bayonet base including GU5.3, G4, P28s, and B22d.

In other Modified Examples concerning the light emitting module, the mounting substrate is not limited to the metal-base substrate, and may be an already-available substrate, such as a resin substrate and a ceramic substrate, other than the metal-base substrate. Moreover, the light source is not limited to the source using LEDs, and may be one which uses semiconductor light-emitting elements other than LEDs, such as LDs (Laser Diodes) or EL-elements (Electroluminescence elements), for example. Furthermore, the light source is not limited to the source that emits white light, and may be one that emits light of any other color. In addition, the LEDs may employ any structure type, including a shell type, an SMD (Surface Mounted Device) type, a COB (Chip On Board) type, and a power LED type.

It should be noted that any combination may be employed among the aforementioned various embodiments and the aforementioned Modified Examples.

What is claimed is:

1. An illumination light source comprising:
a light emitting module;
a circuit unit electrically coupled with the light emitting module;
a base electrically coupled with the circuit unit;
a tube-like first housing member including the light emitting module on one opening side and the base on an other opening side, and accommodating the circuit unit inside the first housing member; and
a second housing member including:
a rotary ring body having a rotation axis agreeing with a center axis of the first housing member; and
a plurality of plate-like radiation fins disposed in parallel with one virtual plane containing the rotation axis, and disposed at intervals in a direction orthogonal to the virtual plane,
wherein an inner wall of the rotary ring body surrounds and fits onto an outer wall of the first housing member.

2. The illumination light source according to claim **1**,
wherein the second housing member further includes a tube-like part surrounding the rotation axis,
the plurality of the radiation fins is disposed on an outer side of the tube-like part, and
at least one of the plurality of the radiation fins is disposed at a location outward away from an outer wall of the tube-like part in the orthogonal direction.

3. The illumination light source according to claim **2**,
wherein at least one of the plurality of the radiation fins is disposed on the outer wall of the tube-like part, and
a pass-through part from a first principal face to a second principal face opposite to the first principal face is formed in the at least one of the plurality of the radiation fins disposed on the outer wall of the tube-like part.

4. The illumination light source according to claim **3**, wherein, only in one of two regions partitioned by a boundary surface assumed to be a plane which contains the rotation axis and is orthogonal to the virtual plane, the pass-through part is formed in the at least one of the plurality of the radiation fins disposed on the outer wall of the tube-like part.

5. The illumination light source according to claim **4**, wherein a center of gravity of the second housing member is present in the one region from the rotation axis, in the virtual plane.

6. The illumination light source according to claim **2**,
wherein a first light-through hole is formed in the tube-like part between adjacent two of the plurality of the radiation fins, and in a traveling direction of light emitted from the light emitting module; and
a second light-through hole is formed in a fin, among the plurality of the radiation fins, located in the orthogonal direction from the rotation axis, and in a traveling direction of light emitted from the light emitting module.

7. The illumination light source according to claim **1**, wherein the second housing member accommodates the light emitting module.

8. The illumination light source according to claim **1**, wherein a gap between adjacent two of the plurality of the radiation fins becomes smaller, with increasing distance away from the rotation axis along the orthogonal direction.

9. The illumination light source according to claim **1**, wherein the base is an Edison-type screw base, and a rotation torque required for rotating the second housing member about the center axis is not smaller than 0.5 Nm and not larger than 5.0 Nm.

10. The illumination light source according to claim **1**, wherein the plurality of the radiation fins is disposed on an outer wall of the rotary ring body.

11. The illumination light source according to claim **1**, wherein the first housing member includes:

a first case member;

a second case member; and

a rotation mechanism between the first case member and the second case member, and

wherein the rotary ring body is fitted onto an outer periphery of the second case member.

12. The illumination light source according to claim **1**, further comprising:

a first and second connection terminals disposed in each of the circuit unit and the light emitting module;

a pair of first conduction paths to electrically couple the first connection terminal of the circuit unit with the first connection terminal of the light emitting module; and

a pair of second conduction paths to electrically couple the second connection terminal of the circuit unit with the second connection terminal of the light emitting module,

wherein each path of the pair of the first conduction paths is in contact with each other by a pressing force, and each path of the pair of the second conduction paths is in contact with each other by pressing force.

* * * * *